Opportunity from Catastrophe: A Strategic Approach to Sustainability through Pre-Disaster Recovery Planning (Pre-DRP)

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Abstract: The aim of this research was to understand what elements should be considered in the construction of a pre-disaster recovery plan in order to move society towards sustainability during post-disaster recovery after a natural hazard event. A conceptual framework for Pre-disaster recovery planning (Pre-DRP) based on the Framework for Strategic Sustainable Development (FSSD) was developed and critiqued by professionals in disaster management, resilience thinking, and sustainability in order to collect qualitative data to make the tool more rigorous and applicable to its intended audience. The revised framework, called the Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD), includes a broad set of principles, planning strategies and guidelines, specifically designed to help communities become more resilient to disasters and move towards sustainability through Pre-DRP. As such, the Pre-DRP FSSD may help emergency planners at various levels of government to implement some of the strategic guidelines set out in the Hyogo Framework for Action 2005-2015.

Keywords: Strategic Sustainable Development, Pre-Disaster Recovery Planning, resilience, backcasting, Sustainability Principles, natural disasters, recovery, Framework for Strategic Sustainable Pre-Disaster Recovery Planning, Hyogo Framework for Action.
Statement of Contribution

Our team was formed through a shared desire to help vulnerable communities attain a higher quality of life. This thesis project was undertaken as a combination of efforts by each of the three members of our team, Alicia Livitt, Danielle Hiscock and Kirstin Piirtoniemi. Our personal similarities allowed for a wonderful level of group cohesion and team moral while our differences gave momentum to the entire collaborative process.

Throughout the thesis, our fascination with the topic area would often lead the discussion in many directions. Without Alicia sharing her remarkable ability to turn the many strings of thoughts and abstract ideas into words on paper, this thesis would not be the masterpiece that it is today.

Kirstin’s ability to think critically, especially from an outside perspective, would often lead the team to momentous turning points of insight and allowed us to maintain rigorous clarity of detail in our work.

Danielle’s passion for the topic was a motivating force for the group and led to the unexpected, yet welcomed adventure of volunteering for the Global Platform for Disaster Risk Reduction’s World Reconstruction Conference held in Geneva, May 2011. Her forthright editing style also kept the paper from evolving beyond a reasonable scope.

The tasks were divided according to the experience, talents and interest in learning a new skill of each member. When work in an area of responsibility was completed by one team member it was then passed to the other two team members for revisions, edits and inputs. Each group member’s opinion was considered in all major decisions that were made. All group members were present for all interviews conducted and all participated in the development of the interview schedule.

This thesis project is truly a collaborative work that each member is proud to share and the journey of its creation has been one of inspiration for future contributions to sustainability and disaster mitigation and recovery.
Acknowledgments

This work was undertaken in Karlskrona, Sweden at the Blekinge Institute of Technology under the supervision of the Mechanical Engineering department. We owe abundant gratitude to our advisors, Andre Benaim and Marco Valente, who provided us with direction and reviewed our ideas throughout the writing process. We would also like to thank Edith Callaghan, guest faculty, for her helpful tips on presenting our results.

A huge thank you is especially dedicated to Sanjaya Bhatia and Gerald Potutan from the International Recovery Platform Secretariat in Kobe, Japan for providing resources, expert contacts, and their constructive feedback about our project.

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Our peer cluster group graciously provided feedback during our peer presentations and throughout our journey. We would like to thank them all for their encouragement and comments.

We are sending many thanks to Carl Livitt for his technical expertise surrounding the registering of our domain name and hosting of our website www.pre-drp.org, and for feeding us when we were too busy to cook.

We would also like to give tremendous thanks the following people who contributed their expert feedback: Mike Weickert, Amanda Phan, Clair Rubin, Dr. Will Allen, Josh Folkema, and Daniel F. Lorenz.

Finally, the support of our families (including roommates and classmates) and loved ones during the research period was essential to our wellbeing and we would like to thank them for helping us reach the finish line.

Karlskrona, 2011
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List of Abbreviations

BBB - Build Back Better
CAS - Complex adaptive system
CWGER - Cluster Working Group on Early Recovery
DRR - Disaster risk reduction
DM - Disaster management
FEMA - Federal Emergency Management Agency
FSSD - Framework for Strategic Sustainable Development
GFDRR - Global Facility for Disaster Reduction and Recovery
IASC - Inter-Agency Standing Committee
IRP - International Recovery Platform
LDCs - Least developed countries
NDRF - Natural Disaster Recovery Framework
PEPPER - Pre-event Planning for Post-Event Recovery and/or Pre-Earthquake Planning for Post-Earthquake Rebuilding
Pre-DR - Pre-disaster recovery
Pre-DRP - Pre-disaster recovery planning
Pre-DRP FSSD - Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development
SES - Socio-ecological system
SP(s) - Sustainability Principle(s)
SSD - Strategic Sustainable Development
UN - United Nations
UNISDR - United Nations International Strategy for Disaster Reduction
Executive Summary

Introduction

Today, global human activity is systematically undermining the biosphere’s ability to provide us with ecosystem services to the extent that we are limiting our ability to live well into the future. Human-caused ecological degradation has resulted in a number of issues that affect the socio-ecological system, such as increased natural hazard risks and disaster occurrences. Future trends predict that natural disaster events will continue to increase if society continues to function along its current, unsustainable path. However, proper disaster management (DM) provides opportunities to reduce human vulnerability to natural hazards both before and after a disaster event, and to move society towards socio-ecological sustainability.

Pre-disaster recovery planning (Pre-DRP) is a disaster preparedness measure that may be used to identify and mitigate disaster risks and to guide and coordinate strategic post-disaster recovery actions. Pre-DRP is not widely practiced but is gaining support for its efficiency in determining long-term recovery solutions for disaster affected communities. Subsequently, the researchers think that Pre-DRP planning is an excellent vehicle for moving communities towards socio-ecological sustainability.

As disasters occur in a complex adaptive system (i.e. the socio-ecological system), pre-disaster recovery plans need to be flexible to allow community actors to best adapt in a post-disaster recovery scenario. To this extent, the researchers have developed a conceptual framework based on the Framework for Strategic Sustainable Development that is intended to help emergency planners mainstream resilience and sustainability into community pre-disaster recovery plans.

Research Questions

The primary research question guiding this thesis was:

*How can the Framework for Strategic Sustainable Development be used to structure a tool that guides pre-disaster recovery planning (Pre-DRP) for post-disaster recovery?*
In order to develop such a tool, the following secondary research questions were addressed:

- What systems are relevant to Pre-DRP?
- What criteria constitute successful recovery in Pre-DRP?
- What strategies should be considered to select actions for successful recovery in Pre-DRP?

**Methods**

A literature review was undertaken that covered topics ranging from disaster recovery planning (Sinha 2008; NHRAIC 2001), resilience (Folke et al. 2002; Smit and Wandel 2006; Norris et al, 2008; Lorenz 2010; Holling 2001; Walker et al. 2002; Carpenter 2001), the Hyogo Framework for Action (UNISDR 2005), International Recovery Platform guidance notes on recovery (IRP 2010), vulnerability (Ingram 2006; McEntire 2001), Complex Adaptive Systems (CAS) (Espinosa and Porter 2011; Walker et al. 2002; Smit and Pilifosova 2006), to Strategic Sustainable Development (SSD) (Holmberg and Robèrt 2000). The Framework for Strategic Sustainable Development (FSSD) was utilized to create a new framework for Pre-DRP to be used by emergency planners in various levels of government. The FSSD structure, combined with data obtained during the literature review, led to a prototype version of the Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD). Thereafter, a range of professionals from DM, emergency planning, sustainability and other related fields were consulted through an interview or questionnaire to collect feedback on the Pre-DRP FSSD. This data was then used to revise the prototype and to develop the final version of the Pre-DRP FSSD. The research was conducted in five phases: Phase I - Research Questions; Phase II - Tool Prototyping; Phase III – Data Gathering & Validity Testing; Phase IV - Data Analysis; and Phase V - Tool Revision.

**Results**

*Answers to Secondary Research Question 1: Systems Level*

All of the respondents stated that the biosphere belongs in the Systems level of the framework since society and communities rely on ecosystem services. Most respondents agreed that society was a relevant subsystem to Pre-DRP and many said the definition of society should be more explicit, with several recommendations to break it down into its own subsystems for clarification. Most of the respondents reported the community was an
essential part of the Systems level, with at least three stating that it is important and/or vital. More than half of the respondents said that adaptive capacity belongs in the framework but not in the Systems level. The general theme that emerged was that adaptive capacity is inherent to a system but is not a system itself. Other suggestions for additions to the Systems level were an individual level subsystem and traditional knowledge systems.

*Answers to Secondary Research Question 2: Success Level*

Respondents were generally of the opinion that sustainability as defined by the four Sustainability Principles (SPs) is a realistic measure of success for Pre-DRP.

When asked if resilience in disaster-prone or disaster-affect areas was a widely accepted goal in their work, most agreed that it is.

Four respondents stated that “Success” was perhaps an inappropriate name for the second level of the framework.

*Answers to Secondary Research Question 3: Strategic Level*

The majority of the experts felt that backcasting is a realistic strategy to guide actions during Pre-DRP. Most respondents felt that forecasting was an appropriate strategy to guide actions, although its usefulness was questioned at least once. The general opinion was there would be few things that would hinder planners to use the Prioritization Questions in their strategic action planning, with a few criticisms (e.g. a high degree of social capital built up in the community would be needed in order for them to be affective). Power dynamics and community engagement were highlighted as important thematic constructs that should be included in the Strategic level.

*Modifications to the Pre-DRP FSSD*

Modifications were made to the Pre-DRP FSSD prototype based on new ideas, relevant material encountered by the researchers and synthesized expert feedback. The final result is the Pre-DRP FSSD model found in Appendix D.

*Discussion*

There was overall positive support for the Pre-DRP FSSD. Its broadness was seen both as a weakness, in terms of not being prescriptive, and a
strength, in terms of its flexibility. Due to an inherent focus on disaster response versus recovery, current, limited use of Pre-DRP in DM, and lack of real testing the Pre-DRP FSSD may not initially seem useful to governments. However, it represents a step in the right direction as it provides communities with an opportunity to engage in strategic post-disaster recovery actions that promote increased resilience and socio-ecological sustainability.

**Reflections on the Systems Level**

Interviewees generally agreed that the biosphere, and its nested subsystems, society and community, (and not adaptive capacity) represented the Systems level of the Pre-DRP FSSD. The researchers agreed that the contents of Society and Community could be strengthened with the addition of descriptive subcategories and an emphasis on the individual and human needs, respectively.

**Reflections on the Successful Outcomes Level**

Sustainability and resilience are relevant and interlinked goals, though they separately address considerations for Pre-DRP. The definition of sustainability in the Pre-DRP FSSD is based on principles, which offers a unique and rigorous contribution to the field of Pre-DRP. The Pre-DRP FSSD’s definition of resilience may help standardize the measurement of resilience and promote a common approach to resilience building within the practice of Pre-DRP.

**Reflections on the Strategic Level**

The planning methods of forecasting and backcasting, were perceived to be useful in Pre-DRP, however, backcasting is currently underutilized in DM practices. Also, Prioritization Questions were found to keep the priorities outlined in the Successful Outcome level at the forefront of the decision-making process, which is useful for evaluating potential tradeoffs. Suggested strategic guidelines were also met with general acceptance.

**Scope and Application of the Pre-DRP FSSD**

The Pre-DRP FSSD is intended for use by emergency planners at any level of government. It promotes a systems perspective that is typically lacking in DM, which may help combat compartmentalization within the field of recovery. In addition, as a wide spectrum of stakeholders are affected by disasters, it is important not to exclude them from the Pre-DRP process as it is the process, not the plan, that is the most critical product of Pre-DRP.
Research Limitations and Strengths

Time, resources and researcher experience were all limiting factors in the development of this thesis. However, the research was strengthened through the use of expert feedback and concrete, operational definitions of sustainability and resilience within the Pre-DRP FSSD.

The Future of the Pre-DRP FSSD

A practical application of the framework is needed in order to identify all its weaknesses, strengths and to determine its vigor, robustness and the value of its contribution to the field of Pre-DRP. Due to the infancy of Pre-DRP research, there is great room for growth. Future research could focus on how SSD can improve other areas of disaster risk reduction, such as post-disaster needs assessments (PDNAs)

Conclusion

Humans face increasing vulnerability to natural disasters due to a multitude of factors within our complex socio-ecological system. Compounding this threat is growing strain on ecosystem services due to unsustainable development in response to population growth. Pre-DRP is an under-researched area of DM although interest in it is increasing. The Pre-DRP FSSD can improve pre-disaster planning for post-disaster recovery by: a) offering scientifically agreed upon principles to guide sustainable recovery actions; b) offering a measurement of resilience that is suited to monitor resilience building; c) framing Pre-DRP with a systems perspective in order to facilitate the inclusion of sustainable actions leading to a society that is built back better; d) offering strategic guidelines to enable the best coordination of resources; and e) being flexible/broad enough for users to adapt to various planning contexts. The Pre-DRP FSSD remains to be tested by different levels of government to discern its overall robustness and to identify areas for further improvement.
Glossary

**Adaptation** - The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (UNISDR 2009).

**Adaptive Capacities** - Resources with dynamic attributes, i.e., resources that are robust, redundant, or rapidly accessible (Norris et al. 2008).

**Backcasting** - A method in which future desired conditions are envisioned and steps defined to attain those conditions, rather than to take steps that are merely a continuum of present methods extrapolated into the future (Holmberg and Robèrt 2000).

**Biosphere** - Region occupying the full space above the lithosphere (Earth’s crust) to the outer limits of the atmosphere (Robèrt et al. 2001).

**Capacity** - The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals (UNISDR 2009).

**Community Resilience** - A process linking a set of networked adaptive capacities to a positive trajectory of functioning and adaptation in constituent populations after a disturbance (Norris et al. 2008).

**Complex Adaptive System (CAS)** - Non-reductive systems in which many agents, elements, and subsystems interact in densely connected networks (Espinosa and Porter 2011).

**Coping Capacity** - Ability of people, organizations and systems using available skills and resources, to face and manage adverse conditions, emergencies or disasters (UNISDR 2009).

**Disaster** - A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (UNISDR 2009).

**Disaster Management** - The body of policy, administrative decisions and operational activities that pertain to disaster prevention, mitigation,
preparedness, response, recovery and rehabilitation at all levels of government (DLPG 1998).

**Disaster Risk Reduction (DRR)** - The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009).

**Framework for Strategic Sustainable Development (FSSD)** - A five-level planning framework consisting of a backcasting planning process for sustainable development based on four principles (system conditions) for sustainability (Broman, Holmberg and Robèrt 2000).

**Hazard** - A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UNISDR 2009).

**Mitigation** - The lessening or limitation of the adverse impacts of hazards and related disasters (UNISDR 2009).

**Natural Hazard** - Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UNISDR 2009).

**Preparedness** - The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions (UNISDR 2009).

**Pre-Disaster Recovery Planning (Pre-DRP)** - A systematic approach that aims to identify recovery planning issues and potential strategies through a participatory process, with a view to putting in place appropriate measures prior to the occurrence of a disaster (IRP 2010).
Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD) - a planning tool to guide strategic preparation and post-disaster recovery activities, in an effort to mitigate risks and help society build back sustainably, toward an overall goal of improved community resilience. It also supports the aims of the Hyogo Framework for Action 2005-2015 (HFA).

Rapidity - One of three dynamic attributes of resources; how quickly the resource can be accessed and used (mobilized) (Norris et al. 2008).

Recovery - The restoration, and/or improvement of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors (UNISDR 2009).

Redundancy - One of three dynamic attributes of resources; the extent to which elements are substitutable in the event of disruption or degradation (Norris et al. 2008).

Resilience - The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (UNISDR 2009); Resilience is expressed as linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance (Norris et al. 2008).

Resources - Objects, conditions, characteristics, and energies that people value (Norris et al. 2008).

Response - The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected (UNISDR 2009).

Risk - The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions. Risk is conventionally expressed by the notation Risk = Hazards x Vulnerability (UNISDR 2004).
Robustness - One of three dynamic attributes of resources; resource strength, in combination with a low probability of resource deterioration (Norris et al. 2008).

Sustainable Development - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Bruntland Commission 1987).

Strategic Sustainable Development - A sustainable development planning approach based on scientific principles and a holistic understanding of sustainability designed to support decision making towards a sustainable society (Holmberg and Robèrt 2000).

Sustainability - A state in which the four principles for sustainability are not violated (Ny et al. 2007). See Sustainability Principles.

Sustainability Principles - The system conditions (or basic principles) for ecological and social sustainability. They state that in a sustainable society, nature is not subject to systematically increasing…
1. … concentrations of substances extracted from the earth’s crust;
2. … concentrations of substances produced by society;
3. … degradation by physical means; and
4. … and, in that society, people are not subject to conditions that systematically undermine their capacity to meet their own needs (Robèrt et al. 2001).

Society - The economic, social and physical infrastructure for the common benefit of humanity that is an open system in relation to the resources provided by ecosystem services.

Socio-ecological system (SES) - Consists of a bio-geo-physical unit and its associated social actors and institutions. SESs are complex and adaptive and delimited by spatial or functional boundaries surrounding particular ecosystems and their problem context (Glaser et al. 2008).

Vulnerability - The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR 2009).
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1 Introduction

This section first presents a background of the global sustainability challenge in relation to natural disasters and identifies pre-disaster recovery planning as a strategic process that can move society move towards sustainability. In particular, this section frames the need for society to increase its resilience to natural disasters and illustrates the benefits of the Strategic Sustainable Development approach to planning that could be used in pre-disaster recovery planning.

1.1 The Sustainability Challenge

We currently live in a world characterized by a Sustainability Challenge. As illustrated in Figure 1.1 below, the compounding pressure of ecosystem decline and a decrease in the availability of global resources (such as arable land, fish stocks, and oil reserves) in addition to the growing demands and consumption rates of an expanding human population, has created a situation that endangers the future health of human society and the rest of the natural world. This can be represented as a metaphorical “funnel” of eroding resource and ecological limits, illustrating how human activities are undermining the ability of natural systems to support society into the future (Broman, Holmberg and Robèrt 2000). Since society is a dependent subsystem of a larger finite system, the biosphere, permanent continuation of these trends is impossible. If human activities continue at their current pace, the capacity of the biosphere to provide essential ecosystem services, such as clean air, water, and fertile soil, will decrease. This intensifying erosion of the socio-ecological system (SES) escalates the likelihood of society ‘colliding with the walls of the funnel’, which can manifest in an assortment of manners including economic losses, conflicts over scarce resources, species extinction and, of most interest to this thesis, disaster events.

In particular, disasters can accelerate the loss of capacity within our SES, or in other words, rapidly ‘narrow the walls of the funnel’ due to the disruptions they cause to the normal functioning of both economic and environmental systems. Given this understanding, as disasters are a manifestation of the narrowing of the walls of the funnel, it is only intuitive that we explore how human activity currently influences disasters in order to reduce our systematic contributions to their occurrences.
1.2 Defining Disasters

Clearly stated, a disaster is a function of the risk process where an affected society is unable to use its own resources to cope with a serious disruption of its normal functioning due to a hazard event (UNISDR 2009). A disruption may take the form of widespread human, material, economic, or environmental losses and impacts and are caused by hazards that have either anthropogenic or natural origins.

Anthropogenic disasters result from hazards that are directly linked to human activity, such as terrorism events or technological hazards where the danger originates from “technological or industrial accidents, dangerous procedures, infrastructure failures or certain human activities [such as oil spills]” (UNISDR 2004).

On the other hand, a ‘natural disaster’ refers to a situation where a society’s normal functioning has been seriously affected by a natural hazard, which is defined as a natural process or phenomena that occurs in the biosphere that could constitute a damaging event (UNISDR 2004). Natural hazards are classified according to three types: hydro-meteorological, geological or biological (see Table 1.1).
Table 1.1. Types of natural hazards.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro-meteorological</td>
<td>Natural processes or phenomena of atmospheric, hydrological,</td>
<td>• Flood, debris and mudflows</td>
</tr>
<tr>
<td></td>
<td>oceanographic or climatological nature</td>
<td>• Tropical cyclones, storm surges, wind, rain and other severe storms,</td>
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<tr>
<td></td>
<td></td>
<td>blizzards, lightning</td>
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<tr>
<td></td>
<td></td>
<td>• Drought, desertification, wild fires, temperature extremes, sand or dust storms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Snow avalanches</td>
</tr>
<tr>
<td>Geological</td>
<td>Natural earth processes or phenomenon</td>
<td>• Earthquakes, tsunamis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Volcanic activity and emissions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mass movements, landslides, rockslides, liquefaction, submarine slides,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Surface collapse, geological fault activity</td>
</tr>
<tr>
<td>Biological</td>
<td>Processes of organic origin or those conveyed by biological vectors,</td>
<td>• Outbreaks of epidemic diseases, plant or animal contagion and extensive infestations</td>
</tr>
<tr>
<td></td>
<td>including exposure to pathogenic micro-organisms, toxins and bioactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>substances</td>
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</tbody>
</table>

Source: Benson, Twigg and Rossetto. 2007.

Regardless of their classifications, hazards can include latent conditions that may represent future threats and can be “single, sequential or combined in their origin and effects” (UNISDR 2004). To this extent, this thesis will omit anthropogenic disasters and will specifically focus on disasters that are caused by natural hazards. At the same time, the researchers acknowledge that natural hazards can be influenced by anthropogenic activity, and therefore, some natural disasters are initiated or amplified by environmental degradation caused by human processes (Twigg 2004; UNISDR 2004). To explain, human behavior can damage the natural resource base and adversely alter ecosystem cycles leading to conditions such as soil erosion, deforestation, desertification, woodland fires, loss of biodiversity, pollution, climate change, and sea level rise. These effects, as well as being dangerously self-perpetuating, increase the frequency and intensity of natural hazards, which contributes to the sustainability challenge described above.

An additional underlying cause of society’s vulnerability to disaster is the widely held and flawed view of “humanity as decoupled from, and in
control of, nature” (Folke et al. 2002, 8). Contrary to this idea, the world we live and operate in is not neatly set out into separate systems comprised of linear-relationships. Namely, the Earth’s socio-ecological system is not comprised of “society plus the biosphere”; rather, society exists within and depends on the biosphere for ecosystem services. Thus, the socio-ecological system is based on complex interconnections between humanity and the biosphere and consequently, disasters are disturbances that affect the interactions within that system.

1.2.1 Disasters within a Complex Adaptive System (CAS)

Recognition that human and ecological systems are interlinked has grown along with the understanding that resilience to disasters “relates to the functioning and interaction of the systems rather than to the stability of their components” (Klein, Nicholls and Thomalla 2004, 11). The socio-ecological system is characterized by interconnections including self-organizing feedback loops, which cause it to behave as a complex adaptive system (CAS) (see Figure 1.2) (Folke et al. 2002). As such, unpredictability is inherent to the socio-ecological system, and it adjusts its operations in response to conditions that are in a continual state of flux (Smit and Pilifosova 2003).

![Figure 1.2. A simplified representation of a CAS (Sunday Traders Club 2011).](image)

To clarify, components within a CAS exist in complex, non-linear relationships with each other and those relationships undergo continuous changes due to constant exposure to stresses and shocks (Folke et al. 2002).
Further, a CAS is constantly susceptible to disruptions that can change the normal functioning within it (Kapucu 2009). Disasters, which embody complex and unpredictable disruptions, are also characterized by continuously evolving complex processes that involve many evolving relationships (Kapucu 2009). For example, if a social system (CAS) that requires clear communication among organizations and groups is affected by a natural disaster, the system of communication and coordination between those entities needs to be highly effective so that it can reestablish the communication as quickly and effectively as possible (Kapucu 2009). As the various entities within the communication system change their relationships with one another in reaction to the disaster, the system as a whole changes its relationship to the environment in which it operates (Kapucu 2009). Operating under changing conditions, a CAS is able to relocate resources and actions within itself to achieve certain goals (Kapucu 2009). Knowing how a CAS functions can help us better understand the ways in which communities may be influenced and affected by a natural disaster. In particular, it can help us understand how current human activity is linked to the occurrence of natural disasters within the SES.

1.3 Human Influences and Patterns

Since the Industrial Revolution, unsustainable human interactions with the environment have essentially caused a shift in the SES to the extent that it is now more prone to severe system disruptions or disasters caused by natural hazards. For example, the increasing human population and its desire to systematically burn fossil fuels has led to an unnatural increase in the amount of carbon dioxide in the atmosphere, which has subsequently led to an increase in the Earth’s average global temperature (Forster et al. 2007). Since natural disasters are related to weather and climate events, disaster occurrences are directly related to changing weather patterns that are influenced by global warming (UNDP 2010). Human activity related to climate change may also indirectly affect the severity of natural hazard events (WB and UN 2010). For example, mining fossil fuels for the transportation industry may involve the systematic removal of forested areas that act as a natural barrier against hurricane winds. With the removal of such forest barriers, hurricane winds may exert more force on community infrastructure, and potentially cause more damage.
In addition, it is interesting to note a similar increasing trend between global human population growth and modern day, natural disasters (see Figure 1.3 and Figure 1.4).

Figure 1.3. Number of natural disasters registered from 1900-2005 (UNISDR 2006).

Figure 1.4. Global Population Growth 1750-2150 (United Nations 1998).
The trends depicted in the figures above can both be linked to increasing human development. To explain, humans respond to population growth through development activities, such as rapid urbanization, in order to accommodate the growing needs of the population. At the same time, many development processes undermine or harm ecosystem services, and consequently affect or influence the occurrence of natural disasters (UNDP 2004). For example, deforestation, land degradation, water and air pollution, biodiversity loss and infrastructural investments in high risk disaster areas are some of the ways that humans undermine the ecosystem and make themselves more susceptible to natural hazards.

Overall, the potential effects of environmental degradation related to human development can be varied and may contribute to an increase in the frequency and intensity of natural hazards as well as human vulnerability (UNISDR 2004). Thus, if these unsustainable human behaviors do not cease, disaster occurrences and risks will only increase into the future.

1.4 Current and Future Disaster Trends

Regardless of where humans locate their communities, they cannot avoid exposure to natural hazards. As Figure 1.5 illustrates, natural disasters can and do occur in all regions that are inhabited by humans, with East Asia (Asia Pacific) experiencing the highest number of events between 1970 and 2010 (WB and UN 2010).

![Figure 1.5. Geographical regions affected by disasters (WB and UN 2010).](image-url)
In addition, disaster statistics show that approximately 75% of the world’s population lives in an area that has been directly affected at least once by an earthquake, tropical cyclone, flood or drought between 1980 and 2000 (UNDP 2004).

As mentioned in Section 1.3, anthropogenic climate change has an influence on disaster events. About two thirds of all natural disasters are related to weather and climate events, and their occurrences will likely increase in the future due to global warming (IRP 2010; UNDP 2010). In a report released by the World Bank and the United Nations (2010), evidence shows that climate change shortens the return period (pattern of reoccurrence) of large storms (see Figure 1.6). This may lead to more frequent disaster risks for populations that live in storm prone areas. In addition, the severity of damaging storms will inevitably become more frequent in a warmer climate (WB and UN 2010).

![Figure 1.6. Climate change shortens the return period of large storms (WB and UN 2010).](image)

Human population growth in connection with natural disasters is also concerning when looking at future predictions. By 2050, the world’s urban population is predicted to be 6.4 billion and the global human population is expected to level out near 10 billion (UNPD 2008). As 70% of the globe is
expected to live in cities by 2050 compared to 50% in 2010, rapid urbanization (i.e. development) will inevitably lead to new disaster risks, thereby raising particular concerns for developers, planners and mitigation strategists (UNDP 2004). Even today, the UNDP reports that “the growth of informal settlements and inner city slums… has led to the growth of unstable living environments… often located in ravines, on steep slopes, along flood plains or adjacent to noxious or dangerous industrial or transport facilities” (UNDP 2004, 2). Unless urban authorities and private actors maintain their capacity to supply housing or basic infrastructure at a rate that matches the expected population expansion, risks to natural hazards will accumulate quickly as people continue to settle in hazard prone areas (UNDP 2004).

Since the 1900s, the number of reported natural disasters has been steadily increasing, with hydro-meteorological hazards being the most common (refer back to Figure 1.3) (UNISDR 2006). For that reason, human populations need to analyze their vulnerabilities in order to assess their hazard risks.

1.4.1 Disaster Risk and Vulnerability

According to the United Nations, risk refers to “the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions” (UNISDR 2004, 7). It is often expressed by the notation, Risk = Hazards x Vulnerability, where vulnerability refers to “the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard” (UNISDR 2004; UNISDR 2009, 30). The close relationship between risk and vulnerability makes them integral parts of disaster discourse.

The scale of impact from a disaster generally depends on the level of a community’s vulnerability to the natural hazard. To explain, the greater the vulnerability of a community, the greater its risks are to hazards. Vulnerability may be influenced by various interactions between economic, social, cultural, institutional, political, physical, environmental and psychological factors in the surrounding environment (Twigg 2004; UNDP 2004).
In particular, research from the past 30 years has shown that communities faced with significant socio-economic challenges, especially in least developed countries (LDCs), tend to be disproportionately more vulnerable to the effects of disasters than their privileged counterparts (Twigg 2004). Specifically, Twigg (2004) has recognized that LDCs are most affected by natural disasters due to increased vulnerability. For example, between 1992 and 2001, 96% of human deaths caused by a natural hazard and 98% of people directly affected by natural disasters globally, lived in countries characterized by medium or low human development indicators (Twigg 2004). In addition, the UNDP observed that between 1980 and 2000, 53% of recorded deaths from exposure to a natural hazard were in countries with a low human development level although LDCs only contain 11% of the total number of people exposed to natural hazards (UNDP 2004).

Other factors such as gender, age and health can also indicate levels of vulnerability within a community. For instance, women, children, the elderly, physically or mentally disabled, poor, chronically ill, displaced or migrant people and other socially marginalized groups often face greater challenges during a disaster (Pyles 2011). This is because they are typically more vulnerable to hazards, based on the social, cultural, economic and political environments that influence their decision making power (Benson, Twigg and Rossetto 2007). Poor people may “also exacerbate their own risk where limited livelihood opportunities force over-exploitation of the local environment” (Benson, Twigg and Rossetto 2007, 32). For example, low-income families may build settlements in dangerous housing locations (e.g., on flood plains, riverbanks or steep slopes) simply because they have no other choice, thus increasing their vulnerability to potential hazards (Benson, Twigg and Rossetto 2007).

On the whole, vulnerability to disasters can be debilitating if communities do not work to increase their capacity to withstand or cope with a disaster. Therefore, reducing vulnerability is a desired goal in disaster risk management. In order to do so, communities can counterbalance their vulnerability through actions that increase their resilience.

1.5 Resilience in a Complex Adaptive System

Resilience is important to consider in the disaster context as it is perceived to be a “desirable property of natural and human systems in the face of a
range of potential stresses,” including natural hazards (Klein, Nicholls, and Thomalla 2004, 1). Much of today’s research on resilience is based on the work by Crawford Stanley Holling, who described resilience as a measure of the ability a system to absorb changes within its variables and parameters yet still persist (Holling 1973).

Within the context of disaster risk reduction, the UNISDR (2002) describes resilience as being determined by the degree to which the social system is capable of organizing itself and the ability to increase its capacity for learning and adaptation, including the capacity to recover from a disaster. This serves as the definition of resilience in this thesis.

1.5.1 Resilience and Sustainability

The link between resilience and sustainable development is often observed in disaster management literature (Carpenter et al. 2001; Folke et al. 2002; Klein, Nicholls, and Thomalla 2004). For instance, Walker and Salt believe that “the key to sustainability lies in enhancing the resilience of socio-ecological systems, not in optimizing isolated components of the system” (2006, 9).

Resistance to widespread change may impart some level of stability in society yet there exists a “large risk that this apparent stability is not sustainable and could lead to collapse if society cannot make the social, economic and political changes necessary for survival” (Klein, Nicholls, and Thomalla 2004, 10). Alternatively, a society that nurtures proactive resilience and acknowledges inevitable changes in system conditions is more likely to directly target the underlying causes of environmental problems in an attempt to create a more flexible and adaptable system (Klein, Nicholls, and Thomalla 2004).

Ultimately, society can move toward long-term sustainability by strategically increasing the resilience of elements within the SES that we depend on for renewal. When massive transformation is inevitable, resilient systems contain the options needed for renewal and reorganization (Folke et al. 2002). The critical aspect of resilience that allows adaptation to new system conditions is called adaptive capacity.
1.6 Adaptive Capacity

According to the Resilience Alliance, ‘adaptive capacity’ is a main component of resilience (Folke et al. 2002). Essentially, adaptive capacity is the capacity of a system to adapt to changing conditions (Folke et al. 2002; Walker et al. 2002; Brooks 2003; Smit and Pilifosova 2003; Smit and Wandel 2006; Norris et al. 2008; Kuhlicke 2010). Reflecting the flexibility and learning qualities of resilience, it may be described as the “capacity of a system to modify or change its characteristics or behavior so as to cope better with existing or anticipated external stresses” (Brooks 2003, 8). Systems with high adaptive capacity are able to re-configure themselves after a disturbance without significant declines in crucial functions (Folke et al. 2002).

1.6.1 Determinants of Adaptive Capacity

At the community scale, there are a number of social mechanisms that generate adaptive capacity which makes adaptive capacity the collective outcome of a combination of determinants, or the characteristics of a community that shape its propensity to adapt (Smit and Pilifosova 2003, Smit and Wandel 2006). As adaptive capacity is highly context-specific, it is usually conveyed in terms of broad categories, such as social, political or economic, among others (Smit and Wandel 2006, Smit and Pilifosova 2003). For example, the level of political influence a municipal government has on national level policies may illustrate the political category.

In a world of constant flux, determinants like “population pressure or resource depletion may gradually reduce a system’s coping ability… while … improvements in technology or institutions may lead to an increase in adaptive capacity” (Smit and Wandel 2006, 288). Changes in these dynamic conditions can be negative or positive, creating vulnerabilities or opportunities for adaptation (Smit and Wandel 2006).

1.6.2 Adaptation and Vulnerability

The social-ecological approach to resilience emphasizes adaptive capacity, flexibility, learning and innovation (Folke et al 2002) as contributing factors to the capacity of a system to resist or absorb stress, while still retaining its basic function and structure (Walker and Salt 2006). Resilience is essentially the ‘flip-side’ of vulnerability (Folke et al. 2002, Klein,
Nicholls, and Thomalla 2004, Holling 1973) as reduced vulnerability equals improved resilience, and vice-versa.

Community adaptive capacity “is linked to and depends on larger and inclusive social systems like societies, its resources, and its capacities” (Smit and Wandel 2006, Lorenz 2010, 8). In addition, broad regional environmental and social forces interact with local level factors to determine community exposures, sensitivities, and tolerance to changing system conditions (Smit and Wandel 2006). For instance, most determinants of adaptive capacity are localized (e.g. the presence of a strong kinship network which will absorb stress) while others are reflective of more general regional socio-economic and political systems (e.g. the availability of state-subsidized crop insurance) (Smit and Wandel 2006).

Where adaptation is possible it may not always be accessible, as vulnerable communities may not be able to prepare or implement options for adaptation (Klein, Nicholls, and Thomalla 2004). Yet, practical initiatives that can improve societal adaptive capacity often manifest at the community level (Smit and Wandel 2006).

Communities with an awareness that conditions have or soon will change can pursue planned adaptation as a practical means to reduce losses or benefit from opportunities (Smit and Pilifosova 2003). The intent of planned anticipatory adaptation is to reduce a system’s vulnerability by diminishing risk or enhancing adaptive capacity (Smit and Pilifosova 2003). As the UNISDR (2009) points out, many disaster risk reduction measures can directly contribute to better adaptation. An opportunity to increase community resilience and adaptation to disasters exists through the practice of good disaster management processes. An overview of disaster management is presented below.

1.7 Disaster Management

1.7.1 The Disaster Management Cycle

Disaster management is the process of presiding over preparation activities and reactions to a disaster both before and after it has occurred. To simplify what is entailed, modern disaster management is often described as a cycle
and is categorized into a number of distinct phases that tend to exist in a continuum where each phase leads into the next (Coppola 2007).

The conventional disaster management cycle generally occurs over four phases: mitigation, preparedness, response and recovery (see Figure 1.7) (O’Brien et al. 2010; Copolla 2007; Twigg 2004) although some interpretations of the cycle include a prevention phase and/or modified versions of the response or recovery phases.

Figure 1.7. The four phases of disaster management (adapted from Twigg 2004).

Mitigation and preparedness activities are carried out in the pre-disaster stage of disaster management. The mitigation phase consists of actions taken to prevent or reduce the adverse impacts to life, property, social and economic activities, and natural resources from hazards and related disasters (UNISDR 2009). These actions serve to increase the awareness, education and preparedness of society members. Some examples of these actions include installation of prediction and warning systems and the adoption of land use and zoning practices, and updated building codes. Often done concurrently, the preparedness phase involves the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current hazard events or conditions (UNISDR 2009).
The response and recovery phases take place after a disaster event has occurred. The response phase is dedicated to meeting immediate needs right after a disaster occurs, such as saving lives, reducing health impacts, ensuring public safety and providing basic subsistence (UNISDR 2009). Most public interest and attention is directed at the response phase over the others because it embodies emergency, is more visible and measureable in the short term and is often publically broadcast by the media (O’Brien et al. 2010; Downer 2008).

The recovery phase has the biggest physical impact on the community (IRP 2011). It is defined as “the restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors” (UNISDR 2009, 23). The recovery phase traditionally begins soon after the emergency response has ended, though the boundary between the two is not always clear. Recovery itself has three distinct phases, short-, mid- and long-term (see Table 1.2 below) (Sinha 2008).

Table 1.2. Disaster recovery phases (Sinha 2008).

<table>
<thead>
<tr>
<th>Short-term recovery stage</th>
<th>During the first hours and days after an emergency event (short-term recovery stage) the principal objectives are to restore the necessary structural (facilities, critical systems/infrastructure, roadways and grounds) and non-structural, (power, water, sanitation, telecommunications).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-term recovery stages</td>
<td>In the first weeks after a major emergency event (mid-term recovery stage), the principal objectives are to ensure the restoration of the all pre-identified business functions considered to be critical to normal livelihood operations.</td>
</tr>
<tr>
<td>Long-term recovery stage</td>
<td>During the long-term recovery stage, the principal objective is to resume normal operations integrated with long term development. It is during this stage of recovery that the emergency phase gets deactivated, and pre-disaster structure of governance and delivery comes into being.</td>
</tr>
</tbody>
</table>
Recovery is also characterized by two stages; early recovery, which “begins early in a humanitarian setting” and “should be guided by development principles in the long run”; and recovery, which focuses on “how best to restore the capacity of the government and communities to rebuild and recover from crisis and to prevent relapses” (Sinha 2008, 110-111). According to Sinha, “the transition between early recovery and recovery is a process of identifying development needs and beginning the work of recovery as early as possible” (2008, 111). Because of its multi-phase, complex nature, disaster recovery is ideally pre-planned to delineate clear responsibilities, policies and strategies for action (UNISDR 2009). In addition pre-planning the recovery phase may help communities effectively coordinate actions that tend to overlap both response and early recovery, such as the provision of temporary housing and water supplies (UNISDR 2009).

According to the International Recovery Platform (IRP) (2010, 7), “preparing for response is an accepted investment, given its additional complexity, [but] preparing and planning for recovery is critical”. Recovery can greatly influence the reconstruction of physical infrastructure as well as cultural and social capacity, resilience, vulnerability and susceptibility to risks (IRP 2011). As such, recovery is fundamentally development-oriented as it “involves compressing decades of development into a few years while reducing future risks, including those from climate change” (IRP 2011, 5).

1.7.2 Recovery Opportunities

People tend to blame disasters for problems that appear to arise after the event but in reality, disasters usually expose pre-existing problems within a community (IRP 2011). Thus, the recovery phase provides an advantageous opportunity for communities to improve their quality of life, local economy and local environmental conditions (Smith and Wenger 2007). This general concept, applied to disaster management, is widely known as the “build back better” approach, which in the words of former US President Bill Clinton means, “making sure that, as you rebuild, you leave communities safer than they were before disaster struck” (IRP 2011, 1). This is precisely one of the goals of a process called pre-disaster recovery planning (Pre-DRP), which allows planners to strategize effective, post-disaster recovery actions in the pre-event, preparedness phase (IRP 2011).
1.8 Pre-Disaster Recovery Planning (Pre-DRP)

1.8.1 Definition and Origin of Pre-DRP

The concept of Pre-DRP has evolved since it first advanced in the 1980s when it was known as “pre-event planning for post-event recovery”, under the acronym PEPPER (NHCAIC 2001). The same acronym has also been used to label the concept of “Pre-Earthquake Planning for Post-Earthquake Rebuilding” (LA Plan 1994). The authors of the initial PEPPER study recommended that the planning process capture anticipated problems and necessary responses leading to the development of policies and procedures for post-event land use planning and rebuilding (CLAEOO 1994). The original concept behind PEPPER is consistent with how Pre-DRP is described today: “a systematic approach that aims to identify recovery planning issues and potential strategies through a participatory process, with a view to putting in place appropriate measures prior to the occurrence of a disaster” (IRP 2010, 1).

1.8.2 Benefits of Pre-DRP

The process of Pre-DRP takes place during the preparedness phase of disaster management as this low-pressure, pre-disaster decision-making environment allows planners to address issues that normally hinder timely developments during post-disaster recovery operations. The City of Los Angeles, an early pioneer of Pre-DRP, justifies the development of Pre-DRP as a “factual basis and analysis needed for post-event decisions” with the understanding “that policy-makers … will be spared the uncertainty and stress of making uninformed decisions in a chaotic post-disaster environment” (CLAEOO 1994, 8). Thus, if local authorities are spared the stress of making timely recovery decisions, it may prevent the occurrence of post-disaster decision-making that builds back risk and vulnerability. For instance, Pre-DRP may have prevented the reconstruction of housing in flood-prone areas in Aceh, Indonesia after the 2004 Indian Ocean tsunami (Sinha 2008). Pre-disaster programs and policies can also be developed as a cost-saving measure to provide governance, legal, technical, financial and community support for mitigation and long-term recovery (NHRAIC 2001; IRP 2011). For instance, Pre-DRP can influence a disaster prone community to begin environmental preservation projects or programs to mitigate their disaster risks, such as the Thai Binh branch of the Vietnam Red Cross did when it undertook the planting of 2000 hectares of mangrove
plantations in the coastal Thai Thuy district in Vietnam. This project held two purposes: first, the mangroves were intended to buffer the coastal communities from expected typhoons and flooding in order to preserve coastal land, human life and physical assets. Secondly, the plantations also contributed to an increase in the production of lucrative seafood exports, which led to increased employment opportunities for the poor and overall increased economic stability in the area (Sinha 2008). Thus, some types of pre-disaster activity may not only reduce future costs, but also lead to higher social equity, economic vitality, and quality of life.

While the process of Pre-DRP is still relatively new, it has gained support from agencies such as the City of Los Angeles, Fairfax County, the Federal Emergency Management Agency (FEMA), the International Recovery Platform (IRP), Inter-Agency Standing Committee (IASC), the Cluster Working Group on Early Recovery (CWGER) and the Global Facility for Disaster Reduction and Recovery (GFDRR) (CLAEEO 1994; Fairfax County 2010; FEMA 2010; IRP 2010). In addition, a recent shift has been discerned in policymakers’, hazards managers’ and the public’s acceptance that planning ahead for recovery is a more beneficial strategy than reacting as it happens (IRP 2011). Thus, the concept of Pre-DRP is evolving and new recovery management paradigms are placing greater emphasis on preparedness, mitigation, and sustainable development in order to reduce disaster risks and “Build Back Better” (IRP 2010; Sinha 2008).

1.8.3 Key Elements of a Pre-DR Plan

Based on the literature that exists around Pre-DRP, the researchers identified a number of key elements that are normally included in a Pre-DR Plan. There are typically two types of information included in such a document: pre-disaster preparedness activities and post-disaster recovery activities. Examples of what might be recorded in a Pre-DR plan could include:

- Development of recovery coordination structures and implementation of long-term training and education of recovery personnel - available to all stakeholders (FEMA 2010).
- Identification and engagement of all stakeholders to ensure a coordinated and comprehensive planning process (FEMA 2010).
- Advanced identification of the processes and procedures that will be used to prioritize decisions and metrics for monitoring progress (FEMA 2010, CLAEEO 1994).
• Establishing clear leadership, coordination and decision-making structures at all levels of government (FEMA 2010).
• Multi-sectoral coordination among international and national actors (Sinha 2008).
• Community participation, inclusiveness and ownership, so that disaster risk reduction (DRR) action points are locally relevant and actionable (Sinha 2008).
• A holistic perspective within the local context (Sinha 2008).
• Development of targeted infrastructure and nonstructural mitigation projects and programs (CLAEOO 1994), and;
• Review and assessment of various economic recovery strategies (CLAEOO 1994).

FEMA and the National Disaster Recovery Framework (NDRF) outline several strategic guidelines that should also be considered in Pre-DRP: individual and family empowerment, leadership and local primacy, preparedness for recovery, partnerships and inclusiveness, communications, unity of effort, timeliness and flexibility, and resilience and sustainability (FEMA 2010; NDRF 2010).

In addition to addressing the points made above, a good Pre-DR plan should strive to integrate the internationally accepted priority actions in the Hyogo Framework for Action (HFA) 2005-2015 through mitigation and preparedness for post-disaster recovery activities.

1.8.4 The Hyogo Framework for Action 2005-2015 (HFA)

The HFA is a 10-year guiding blueprint for disaster risk reduction (DRR) that was negotiated and adopted by 168 countries in 2005. It outlines “principles, priorities for action, and practical means for achieving disaster resilience for vulnerable communities” (UNISDR 2005, 1). As the aim of Pre-DRP is to reduce disaster risks through increased resilience and to identify recovery strategies to build back better during post-disaster recovery, it is an ideal process through which communities can align their actions with the strategies in the HFA. For example, Pre-DRP may act as a vehicle for the implementation of some or all of the following HFA’s priorities for action:

1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.
2. Identify, assess and monitor disaster risks and enhance early warning.
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
4. Reduce the underlying risk factors.
5. Strengthen disaster preparedness for effective response at all levels.
(UNISDR 2005)

At the same time that Pre-DRP is an ideal disaster risk reduction method, it also allows communities to plan for post-disaster sustainable development activities in alignment with the BBB concept.

1.8.5 Build Back Better and Sustainable Development

As previously mentioned in section 1.7.2, the BBB concept has recently become popular with political and humanitarian luminaries in international discourse. It is an important mantra to highlight due to its increased appearance in the wealth of published works promoting ‘sustainable development’ as the vital outcome objective of recovery planning (IRP 2011). The prominence of the concept of ‘sustainable development’ demands a rigorous operational definition if it to be useful to planners, yet the term suffers some ambiguity. UNISDR, for example, has adopted the Brundtland Commission\(^1\) definition of sustainability but notes that “it leaves unanswered many questions regarding the meaning of the word development and the social, economic and environmental processes involved” (IRP 2011). Though groundbreaking, if “true sustainability in human interactions with the biosphere is to be realized, a far stronger and more empirical interpretation of the original intent [of the definition] is urgently required” (Johnston et al. 2007).

As the term is applied to disaster management, Ben Aguirre, Professor in the Department of Sociology and Criminal Justice at the University of Delaware, highlights the potential for misinterpretation of ‘sustainable development’ due to inconsistent and often vague references to it in numerous studies, advocating it as a planning aim. An “umbrella concept”

\(^{1}\) “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” as published in the Report of the Brundtland Commission, *Our Common Future* (WCED 1987)
weak in strict scientific basis, its liberal and rhetorical application has contributed to increased incidences of the term being “largely or wholly devoid of environmental concerns” (Aguirre 2002, 102). This "semantic transformation" of the term in relation to disaster planning has resulted in the exclusion of linkages “either to the protection of the environment, or to sustainability practices, or to the alleviation of social inequities” (Aguirre 2002, 103) allowing misinterpretation to potentially undermine its real world application. Thus, there is a need for a more rigid, operational definition of sustainable development as it applies to disaster recovery.

1.9 Sustainability in Disaster Management

1.9.1 Need for a Rigid Definition of Sustainable Development

The ambiguity of sustainable development in disaster recovery research and policy highlights the great need for researchers and policy-makers to operate from a consistent, concrete definition of sustainability. Planning for sustainable recovery following a disaster can be difficult if a community cannot articulate a shared vision of sustainability into an action plan.

Acting without a strategic, coherent vision for recovery planning can result in a great number of divergent paths that may lead away from sustainability. Within disaster management, failure to view a seemingly isolated problem in the context of how it feeds into other issues can spur organizations to apply “overdoses of established measures” (Dixon 2006, 9) quoting (Dörner 1996, 33). This can be especially troublesome if the consequences of these actions contribute to other persistent long-term problems that may emerge later. For instance, in Hue, Vietnam, the reconstruction of infrastructure such as bridges, railway lines and roads have created a barrier across the valley within which the city is located, subsequently causing flooding from rainfall to become more severe (Sinha 2008). Several villages in Gujarat, India, have experienced similar flooding problems after the construction of a donor-funded highway (Sinha 2008).

Thus, a need for a holistic perspective, operational definition of sustainability and strategic planning exists to prevent poor disaster management from undermining future socio-ecological stability and resilience. In this manner, the Strategic Sustainable Development (SSD) approach is specifically suited for this task.
1.9.2 Strategic Sustainable Development (SSD)

The founders of SSD recognize that a proliferation of definitions for sustainable development has contributed to an ambiguity about its meaning, thereby limiting its credibility and practical significance (Johnston et al. 2007). Thus, they developed rigid system boundaries described by scientifically agreed upon Sustainability Principles to orient planning strategies for sustainability in an inherently dynamic system (Holmberg and Robèrt 2000). In addition, they adapted a generic 5 level planning approach for sustainability as well as a strategic planning process in order to help society tackle the sustainability challenge. The SSD approach is particularly unique in that it provides a systems perspective and principled definition of success from which one must backcast in order to select strategic actions to move towards sustainability. It is operationalized through the use of a planning framework for sustainability named the Framework for Strategic Sustainable Development (FSSD).

1.9.3 The Framework for Strategic Sustainable Development (FSSD)

The FSSD is a tool for organizing complexity without reducing or ignoring aspects of a system. It is comprised of five levels that are based on a five-level framework (5LF) as outlined in Figure 1.8. A systems perspective, Sustainability Principles and backcasting method are all key features of the FSSD. As it contextualizes information in relation to an overarching basis for sustainability, “its main objective is to describe and communicate strategies for sustainable development” (Broman, Holmberg and Robert 2000, 4). In particular, the FSSD can be used to identify shortcomings in relation to the goal of sustainability while maximizing efforts to reach that goal through initiatives that align with a comprehensive vision.

The FSSD can be applied to any planning scenario by any organization in order to strategically move the desired section of society towards sustainability. The five levels within the tool, of which the top three levels are expanded upon below, include the SSD concepts applied to the entirety of society within the biosphere but can be adapted to include additional, context-specific information when being utilized in more specific planning processes:

- The Systems level represents a description of the socio-ecological system, which is grounded by the concept of the sustainability challenge, including the interaction of society within the biosphere, and the governing laws of thermodynamics and natural
biogeochemical cycles;
- At the Success level, Sustainability Principles define the system conditions for socio-ecological sustainability;
- At the Strategic level, backcasting from Sustainability Principles is an explicit strategic guideline for sustainable development and basic action prioritization questions are included;
- The Actions level includes the concrete steps that follow the strategic guidelines for success; and
- The Tools level describes the tools or concepts that are designed to indicate or audit progress towards sustainability e.g., ISO 14001, Life-cycle assessment, and Ecological Footprint (Robèrt 2000).

Figure 1.8. The 5 levels of the FSSD.

The top 3 levels of the FSSD, Systems, Success and Strategic, are essential to any strategic effort to move towards sustainability. Given their importance, these levels will be described in more detail below.

Systems: The Global Socio-Ecological System

The systems level of the FSSD represents the overarching system that is relevant to sustainability, which is the global socio ecological system, or in other words, society within the biosphere (Robèrt et al 2002). Underlying the socio-ecological system are constitutional principles that govern the functioning of the system, which are important to understand as they also describe the different mechanisms by which the system can be destroyed (Robèrt 2000). The goal of sustainable development then, is to phase out
the activities that influence those destructive mechanisms. The principles that govern the global socio-ecological system with regard to sustainability include: “the principle of matter conservation… the laws of thermodynamics… the principles of the sun-driven biogeochemical cycles… the fact that the biosphere cannot sustain systematic shifts of its physical parameters… and society’s dependence on sustainable resource flows and services from the ecosphere” (Robèrt 2000, 248). Understanding the behavior of systems is critical to understanding, and making effective decisions, regarding sustainability in complex adaptive systems (Fiksel 2006).

**Success: Sustainability Principles**

The Success level describes or defines the goal that sets the base for strategic planning to occur (i.e. social and ecological sustainability) within the outlined system.

According to the FSSD, all current ecological sustainability problems can be traced upstream to three fundamental mechanisms (Broman, Holmberg and Robèrt 2000). As informed by the laws of thermodynamics, the fundamental ways that society undermines the natural cycles within the biosphere have been identified as: the systematic build up of substances from the earth’s crust (e.g. fossil fuels, heavy metals); the systematic accumulation of chemicals produced by society including unnatural compounds (e.g. CFCs, DDT); and the systematic degradation of the environment by physical means (e.g. deforestation, overfishing) (Broman, Holmberg and Robèrt 2000). A fourth consideration is the importance of fair management of limited resources since the ultimate purpose of societal structure is to meet human needs (Robèrt et al 2002). Some examples of how human society may violate this condition include allowing employees to work in unsafe conditions, providing unsatisfactory wages, and disenfranchising minority populations. Thus, expressed in terms of constraints, these four system conditions for sustainability can be rephrased as the *Sustainability Principles* (SPs) (refer to Figure 1.9).
In a sustainable society, nature is not subject to systematically increasing:

- 1. concentrations of substances extracted from the earth's crust
- 2. concentrations of substances produced by society
- 3. degradation by physical means
- 4. and, in that society, people are not subject to conditions that systemically undermine their capacity to meet their needs

*Figure 1.9. The four Sustainability Principles (Broman, Holmberg and Robèrt 2000).*

Therefore, noncomplying with the SPs leads down a path of unsustainability. The words “systematically increasing” are distinct to these principles, because the problem does not exist immediately in that we mine heavy metals, produce chemical compounds, or interfere with natural processes; rather, the trouble is that our society operates in such a manner that substances extracted from the earth and compounds produced by society (both natural and foreign to nature) will continue to build up in the ecosystem faster than their levels can be absorbed by natural processes (Robèrt et al. 2002). The progressive buildup of pollutants and substances not only directly poses harm to humans but can also damage natural processes that have taken billions of years to develop and have already been weakened by other human activities, such as habitat destruction.

Blocking the path to sustainability are “systematic errors of societal design that are driving humans’ unsustainable effects on the socio-ecological system” (Robèrt et al. 2010, 9). One example of this is our growing global dependence on fossil fuels, which not only contributes to violations of SP 1, but adds to violations of SPs 2 and 3 through massive carbon dioxide emissions and the stripping of natural habitats to extract, transport and refine crude fuels. Eliminating these flawed societal aspects is challenging.
due to a variety of significant obstacles including economy and tradition. Yet “opportunities for society exist if the obstacles for sustainability are overcome” (Robèrt et al. 2010, 9).

Ultimately, in order to preserve the socio-ecological system, society must avoid activities that violate any of the four Sustainability Principles whenever possible (Robèrt 2000). Therefore, during the strategic planning process, it is desirable to choose actions that will help an organization or entity to move step by step towards full compliance with the SPs, as those actions will lead the process towards the overall goal of socio-ecological sustainability.

**Strategic: Backcasting and Prioritization Questions**

The Strategic level focuses on the strategies for choosing actions that comply with the Sustainability Principles in order to move society towards sustainability (Robèrt et al. 2002).

**Backcasting**

One of the ways that actions or investments should be selected is through backcasting, (see Figure 1.10) which is the concept of working “backward” from a vision of future success (goal) to chart the general path of actions to take in the present towards achieving this goal (Holmberg and Robèrt 2000). In particular, this type of planning methodology is useful when “the system is complex, and when current trends, actions and planning are part of the problem” (Robèrt 2002, 201). It helps planners strategically deal with potential trade-offs from different decisions, which are otherwise often omitted in sustainability efforts (Robèrt et al. 2002). In this way, backcasting from the SPs is a systematic approach that can manage “the kind of complexity that is caused by conflicts between short-term and long-term” in order to move society towards sustainability (Holmberg and Robèrt 2000, 295). It also encourages ambitious solutions by detaching from the constraints of current reality to encourage creativity by allowing people to develop the necessary conditions for their vision to exist. Due to the large amount of uncertainty that characterizes the future, when employing this technique it is useful to frame the future goal with principles rather than to articulate it as a specific scenario so as not to place limits on future success (Holmberg and Robèrt 2000).
Backcasting is also complementary to other planning methods such as forecasting. Forecasting differs from backcasting in that it attempts to predict what the future will look like rather than the way it could look (Robèrt et al. 2010). Forecasting can be applied to investigate whether certain actions and strategy will lead in a desired direction, however, this planning method can be risky exercised on its own “if past trends are allowed to influence or even determine what is considered a realistic strategy” (Holmberg and Robèrt 2000, 294). In addition, when forecasting is used alone, there are risks that “fixing the problems” will “retain the principle mechanisms from which the problems arose...[and] create additional problems in the future (Robèrt 2002, 201). Thus, forecasting is a strategy based in current reality, whereas backcasting allows one to plan beyond the restrictions of current reality and come up with more creative solutions for the future.

Prioritization Questions

The other three elements that form the Strategic level of the FSSD are presented as ‘Prioritization Questions’ to help planners choose appropriate actions to move towards Success. They essentially state that flexible platforms, low-hanging fruit, and the precautionary principle should all be considered when selecting strategic actions (Robèrt 2000). Whether an action provides a flexible platform for future success should be considered, as taking actions that comply with the SPs in the short term and not the long term is insufficient to the goal of sustainability. Thus, investments
should act as “stepping-stones” towards future investments in the same direction (Robèrt et al. 2002, 201). The concept of low-hanging fruit refers to the idea that strategic actions should be given priority if they can yield a good return on investment and the precautionary principle should be heeded when one is unsure of the ecological consequences of a selected activity (Robèrt et al. 2002). Taken together, these principles are to be used along with backcasting from the SPs when selecting and prioritizing strategic actions to arrive at success.

1.10 Description of Research Motivations

When communities plan for sustainability by capitalizing on the recovery process to engage in sustainable development, they can better link “concerns for social, economic and environmental wellbeing in a coordinated process aimed at meeting present needs” i.e. through Pre-DRP (Schneider 2002, 143). This is why the researchers sought to create a tool that incorporates the elements within the FSSD with other elements relevant to Pre-DRP in order to guide the post-disaster recovery process towards a trajectory for sustainability. For this reason, we think that an FSSD application to Pre-DRP could be used to identify general principles to guide post-disaster recovery towards increased resilience and sustainability. The researchers would like to explore what principles and guidelines might belong in the Systems, Success and Strategic levels of the FSSD, if it were to be modified into a tool for strategic Pre-DRP.

Thus, the following research questions were explored:

1.10.1 Research Questions

Main Research Question

How can the Framework for Strategic Sustainable Development be used to structure a tool that guides pre-disaster recovery planning for post-disaster recovery?

In addition, the following secondary research questions will be addressed:

- What systems are relevant to Pre-DRP?
- What criteria constitute successful recovery in Pre-DRP?
- What strategies should be considered to select actions for successful recovery in Pre-DRP?

Scope

This thesis is limited to analyzing pre-disaster recovery planning for disasters caused by socio-natural hazards in communities that experience high levels of vulnerability to natural hazards. For the sake of scope, only natural hazards will be examined and anthropogenic hazards (technological and environmental) will be omitted.
2 Methods

2.1 Research Design

Keeping with the reflexive nature of qualitative inquiry, this study was largely based on Joseph Maxwell’s interactive model of research design (2005). This model illustrates the fluidity and continual evolution of the five components of qualitative design: goals; conceptual framework; research questions; methods, and validity (see Figure 2.1). As the study progressed, adjustments in one or more components influenced the evolution of the other components.

![Figure 2.1: Interactive Model for Research Design (Maxwell 2005)](image)

2.2 The Framework for Strategic Sustainable Development (FSSD)

The Framework for Strategic Sustainable Development (FSSD) was used as a foundation for the creation of a strategic tool for pre-disaster recovery planning due to its utility to support a systematic shift towards sustainability. The FSSD is derived from the generic Five Level Framework (5LF), which is a planning model for organizing complex systems into more comprehensive parts for strategic decision-making in a variety of contexts. From a broad systems view, the FSSD employs a
strategic approach to describe the relevant elements of the system, defines success criteria for sustainability, prioritizes actions leading to sustainability, and supports the selection of tools to measure success. The FSSD is described further in Section 1.9.3 of the Introduction.

2.3 Research Phases and Methods

The research occurred in four overlapping phases as depicted in Figure 2.2

![Figure 2.2 Research Phases and Timeline](image)

2.3.1 Phase I – Research Questions

The primary and secondary research questions coalesced through an iterative process of drawing tighter tangents around the topic through data gathered from the literature review and discussions with disaster management experts. Phase I commenced with an exploratory study of disasters and disaster management history using a variety of resources including peer-reviewed journal articles, books, websites and documents published by disaster relief agencies, NGOs, academic institutions, government authorities, official United Nations and humanitarian assistance reports, and data from the International Recovery Platform. Subjects such as disaster management, mitigation, the emerging ‘Build Back Better’ movement, pre-disaster planning strategies, community resilience and vulnerability, resilience thinking, complex adaptive systems (CAS), and adaptive capacity (AC) were investigated in relation to Strategic Sustainable Development (SSD).

The scope of this research was further refined through discussions with independent researchers Stanley Nyoni and Ben Aguirre, in addition to primary research contacts, disaster recovery experts Sanjaya Bhatia and
Gerry Potutan from the International Recovery Platform (IRP) Secretariat. IRP is an international organization with a mission to “identify gaps and constraints experienced in post-disaster recovery and to serve as a catalyst for the development of tools, resources, and capacity for resilient recovery” (Recovery Platform 2010). Their input, along with an extensive, targeted review of literature on recovery planning, provided the context for narrowing the scope of this thesis as well as the primary and secondary research questions.

2.3.2 Phase II – Tool Prototyping: The Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD)

In Phase II, the researchers synthesized their experiential knowledge of SSD concepts, the FSSD, original concepts that emanated from brainstorming processes, data gathered from the literature review and expert input to develop the prototype of a tool for recovery planners that would guide society’s movement towards sustainability in disaster-prone communities: The Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD). The researchers organized relevant content yielded from the sources described above into the top three levels of the FSSD (Systems, Success and Strategic) with the expectation that this tool could improve the ability of communities to move towards increased resilience and socio-ecological sustainability through post-disaster recovery actions.

The researchers’ understanding of the Systems level was influenced by a schematic model of the Complex Adaptive Systems (CAS) approach to sustainability as described by Espinosa and Porter (2011) and the exploration of recent insights on resilience and vulnerability in social-ecological systems by Folke et al. (2002), a group of internationally renowned scientists from a scientific network called the Resilience Alliance. The concept of CAS was then combined with a conceptual model of community resilience as networked “adaptive capacities” as presented in the American Journal of Community Psychology (Norris et al. 2008), including properties for resilience as adapted from Bruneau et al. (2003), to contribute to the clarity of Systems components and the definition of Success criteria. Analysis of the theoretical recommendations for Pre-DRP found in an article by Sinha (2008) and McEntire, Crocker and Peters’ (2010) ‘four approaches to vulnerability reduction’, contrasted with operational Pre-DR plans like FEMA’s National Disaster Recovery Framework and the City of Los Angeles’ Recovery and Reconstruction
Plan, which led to the development of core criteria for Pre-DR plans within the Strategic level of the tool.

Two core concepts became the criteria comprising the Success level. First, the Sustainability Principles (as described by Section 1.9.3 of the Introduction) were used to offer a scientifically robust definition of sustainability. Given equal importance, resilience theories and concepts from emerging resilience thinking fields were adapted to fit into a Pre-DRP context.

To arrive at the strategic guidelines for the Strategic level of the Pre-DRP FSSD, the researchers reviewed a number of theoretical and/or actual pre-disaster recovery plans for inclusion in their study as discussed in Section 2.2.2 above. The pre-disaster recovery plans were found through an Internet search that included the key words “response plan”, “emergency plan”, “Pre-DRP”, “emergency operations”, “reconstruction plan”, “disaster preparedness”, etc.” as well as those recommended to the researchers by the IRP Secretariat.

The Actions and Tools levels are also included within the framework prototype, but the criteria in these levels is not explored in depth as this information is not easily generalized and should be input by community planners on a plan-by-plan basis.

The resulting prototype, the Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD), was then presented to a cross-section of experts in disaster management and sustainability in the form of semi-structured interviews to gather feedback on the clarity and applicability of the tool. In one case, the interview questions were answered as a questionnaire due to a respondent’s limited availability. The interview questions were designed to assess the relevance of the content at each level of the tool as well as its overall validity. Responses to the interview were analyzed qualitatively to arrive at the answers to the primary and secondary research questions.

2.3.3 Phase III – Data Gathering and Validity Testing

An explanation of the Pre-DRP FSSD prototype including background information and the contents of each level (for context) was sent to seven experts in order to gather feedback on the clarity, relevance, and comprehensiveness of the tool. Their feedback was gathered via semi-
structured interviews and in one case an interview questionnaire was used. Their responses served as a partial validity check on the accuracy of the tool as it relates to the field of disaster management as well as its usability.

**Semi-Structured Interviews**

Interviews were conducted in order to gain a deeper understanding of the views and opinions of people likely to apply the Pre-DRP FSSD or to possess extensive knowledge relevant to Pre-DRP about one or more levels of the tool. The researchers chose to involve experts from diverse backgrounds in order to gain a holistic understanding about the current reality of Pre-DRP with regards to sustainability and resilience building. This approach was chosen in order to limit researcher bias. The target sample selected for interviews included sustainability, resilience, and disaster management academics or practitioners; humanitarian aid workers; governing officials; national and local government emergency planners; and various community leaders of disaster threatened or affected areas. The potential interview subjects were selected by the researchers through a review of authors commonly cited in Pre-DRP literature, an Internet search of academic and professional contributors to DM, resilience or sustainability, as well as contacts made through the IRP Secretariat. Appendix B contains the list of interview participants and their professional titles. The interview design was semi-structured to allow the researchers to ask additional questions when clarification was necessary and to allow them to harvest additional constructive comments that were not directly related to testing the prototype. The interview information was then used to determine revisions to the Pre-DRP FSSD prototype. The list of questions that were presented to the professionals can be found in Appendix C.

Interviews were pre-arranged and took place in Karlskrona, Sweden via the telephone and Internet (Skype) since face-to-face meetings were not possible due to long distances and financial constraints. The interviewees received literature (the interview schedule in Appendix C) surrounding the topic via email a few days to a week before the interview with the assumption that pre-interview literature would allow them to prepare more thoughtful responses.

The interview questions were designed to assess and refine:

- The usefulness of organizing Pre-DRP criteria into the first three levels (Systems, Success, Strategic) of the FSSD
The applicability of the Sustainability Principles to partially define success for Pre-DRP
The use of resilience as a success factor in Pre-DRP
The 3Rs as a way to assess resilience
The applicability of backcasting to guide the selection of strategic actions for Pre-DRP
The four Prioritization Questions and Strategic Guidelines for Pre-DRP; and to
Evaluate the overall usefulness of the Pre-DRP FSSD

The researchers also conducted unstructured Skype interviews with DM and sustainability related professionals whenever the chance was given. These interviews took the form of open discussions with Stanley Nyoni from The Natural Step and Sanjaya Bhatia and Gerald Potutan from the IRP Secretariat. The information gained from these conversations aided the researchers’ understanding of the topic area, but was not directly included in the results.

2.3.4 Phase IV – Data Analysis

For the purpose of data analysis, the feedback from interviews was transcribed and categorized according to themes. Specifically, the transcripts of these interviews were synthesized into a thematic coding frame in order to simplify data organization and to allow the researchers to identify significant and majority responses. General opinions were identified in relation to the contents of the Pre-DRP FSSD prototype and various modifications or omissions were made in accordance with majority responses. In order to do so, a spreadsheet was constructed to include every interview question and every respective response. Extraneous words and phrases (such as “um”) were removed from the transcribed responses in order for the researchers to clearly identify significant information. Thematic constructs were selected by the researchers in accordance with criteria included in the prototype (i.e. biosphere, resilience, backcasting) as a means to identify and analyze the interviewees’ responses. The researchers then independently coded the data contained in the excel sheet and divided it amongst the thematic constructs. The coding took place three separate times, i.e. it was done once by each researcher. Afterward, the coded results were compared and any researcher bias was identified, discussed and eliminated as much as possible. The coded results were then analyzed to identify what revisions needed to be made to the Pre-DRP
FSSD prototype.

When it was possible, data originally obtained as qualitative information from interviewee responses was expressed according to the fraction of interviewees who gave a similar answer versus varied answers to a particular question. Presented in the Results chapter below, interview results were generally expressed as the number of respondents who gave similar responses (x) out of the total responses collected for that question (z). Questions that were not answered were not included in the analysis and were noted as N/A (not applicable) in the coding frame. Key trends from the interview results served as the basis for revisions to the Pre-DRP FSSD prototype.

2.3.5 Phase V –Refinement of the Pre-DRP FSSD

Recommendations and criticisms observed in the interview results were used to update and refine the Pre-DRP FSSD prototype, leading to its current, usable form (see Appendix D). The revisions were made in order to strengthen the applicability of the framework and improve its robustness. Changes made to the Pre-DRP FSSD prototype after the interview data analysis are outlined in Section 3.3.1 of the Results. The final version of the Pre-DRP FSSD still must be validated.
3 Results

Using data gathered during the literature review, the researchers provided preliminary answers to their primary and secondary research questions by developing a theoretical framework (prototype) for Pre-DRP based on SSD concepts. The framework prototype was organized into Systems, Success and Strategic levels, as in the FSSD, in an attempt to sequentially answer the first, second and third secondary research questions. The results of this process can be found in Appendix A.

Following the development of the framework prototype, the core contents from the Systems, Success and Strategic levels were extracted and presented to experts in an interview schedule in order to collect their feedback on the preliminary results (see Appendix C). Background information about the purpose of the framework and relevant Pre-DRP and SSD concepts were also provided in order to enhance the experts’ understanding of the preliminary results.

The results collected from the experts allowed the researchers to revise the preliminary answers to the primary and secondary research questions. The revised answers to the secondary research questions are included below, while the overall result to the primary research question is presented as a final version of the framework (See Appendix D).

3.1 Preliminary Results

The preliminary results to the primary and secondary research questions are presented as a theoretical framework that was developed using data gathered during the literature review and the application of the FSSD to the context of Pre-DRP (for the prototype of the Pre-DRP FSSD, see Appendix A).

3.2 Expert Feedback

This section presents the results that were collected through interviews (and the one questionnaire) about the core contents of the framework prototype, in sequential order of the secondary research questions (i.e. what belongs in the Systems, Success and Strategic levels). The interviewees’ answers were
grouped according to thematic constructs, and are presented as a summary of feedback with attention given to noteworthy or minority opinions about the preliminary results.

3.2.1 Secondary Research Questions:

Secondary Research Question One

What systems are relevant to Pre-DRP?

i. Biosphere

All of the interviewees stated that the biosphere belongs in the systems level of the framework as society and communities rely on ecosystem services. For example, one interviewee told the researchers that “[in our current Pre-DRP project], the biosphere plays into our food chain, natural and cultural resources… Most of these items fit into the mitigation planning because if there are any hazards in the area that will affect those things, we will plan ahead to prevent the worst-case scenario.” The repeating ideas that emerged were: within the biosphere are other systems (society and community) and the biosphere’s ecosystem services should be explicitly stated. Some other ideas that emerged included: the biosphere is not a subsystem; rather, it is the overall system.

ii. Society

Six out of seven interviewees indicated that society was a relevant subsystem to Pre-DRP. The one dissenting response was that society did “not belong in the Systems level as the [researchers] describe it”. Regarding clarification, five out of six interviewees went on to say that the definition of society should be more explicit. Several interviewees recommended that society should be broken down into its own subsystems or elements to make it easier to understand what it represents. For instance, one interviewee answered, “I assume you include residents, business owners, and non-profit organizations in society” while another said “as long as society picks up political and economic factors, I have nothing to add.” A third interviewee acknowledged that “society includes very different actors within the economy… different interest groups,” so “perhaps, [the researchers should] think about subsystems of society.” Overall, these statements indicated that the description of society should include an economic and political subsystem among others, or should include specific actors such as
non-governmental organizations and businesses. Also, one other interviewee noted that society might function as a “supplement for any services that have broken down [at the community level after a disaster].”

iii. Community

All but one of the interviewees reported the community is an essential part of the Systems level, with at least three stating that it is important and/or vital. For example, one interviewee verified this by saying: “[community is] where disaster management actions take place.” Another interviewee reflected on the importance of the community by stating that “when aid workers do not consider it, interactions between society and the biosphere become torn apart.” Another answer that emerged was, “disaster management should be aware of local belief systems and specific needs.” One interviewee stated, “[community] does not belong in the systems level” as the researchers described it.

iv. Adaptive Capacity

More than half of the interviewees said that adaptive capacity should belong in the framework but not in the Systems level. The general theme that emerged was that adaptive capacity is inherent to a system but is not a system itself. For example, one interviewee said, “adaptive capacity is a capacity of a system itself or… outcome of activities within a system… [it] will impact the system but [I am] not sure it can be qualified as a system” Most interviewees also said that it would be useful to group determinants of adaptive capacity into broad categories to aid understanding. Several interviewees suggested that the community capitals would be useful categories for this purpose. One interviewee said that “everyone has different concepts and there will never be an agreed upon set of categories.” Another interviewee added to this idea by stating, “it may be useful to categorize them but there is a lot of overlap.”

v. Additional Reflections about the Systems Level

Overall, all but one of the interviewees thought that the biosphere, society and community belong in the Systems level. In addition, some suggestions were made about additional categories that could potentially fit into the systems level. For example, one interviewee said that an “Individual Level” should be added to the Systems level. Another interviewee thought that
traditional knowledge systems should be added. More than half of the interviewees said they did not have anything else to add to the Systems level.

Several interviewees’ answers included statements about the need to take a systems view when analyzing or assessing issues related to disaster recovery or community development. The general theme that emerged was that it is important to keep a holistic or systems perspective in order to realize the interconnectedness of everything. One interviewee added, “things are not static, they are always changing.” Another interviewee touched on the interconnectedness of things by saying “the society & community…need [the] biosphere and have to manage different aspects of getting resources from [the] biosphere.”

**Secondary Research Question Number Two**

*What criteria constitute successful recovery in Pre-DRP?*

**i. Sustainability**

Five of six interviewees (with one interviewee not responding) deemed sustainability was a relevant aspect of their work, with one interviewee commenting that it was the more important piece by far. However, two interviewees felt that sustainability, as a goal, was too abstract. One commented that “No, [sustainability is] not very relevant” and that one of her “least favorite words in the world” is “sustainability”. This interviewee had done a lot of work with municipalities and she said, “none… sat around worrying about [it].”

**ii. Sustainability Principles (SPs)**

Six of seven interviewees held the general opinion that sustainability as defined by the four SPs is a realistic measure of success for Pre-DRP, although four out of seven responses included an addition or criticism to their agreement. The additional opinions included the thoughts that:

- “Planning towards meeting the SPs would reduce the impact of disasters”;
- “Using the SPs does not highlight the fact that our socio-economic system is dynamic”;
• “The SPs would be most useful while pre-planning for predictable events”;
• “The first SP might be difficult to achieve”

The one dissenting interviewee felt that sustainability as a Pre-DRP goal was too theoretical and “does not find it useful on level of abstraction nor locally relates to [it]”.

In general, there were concerns about the ease of understanding the SPs given their scientific language. For example, one interviewee remarked, “the high level of the principles does not translate easily down to the community level” and “having the SPs as a Success criterion would require extensive explanation on how to operate within them.” Another interviewee thought they might be too general, “since they touch very complex aspects... [but] in actual work, [they] might be difficult… to apply.” However, the same interviewee realized that “they need to be broad for a framework.”

iii. Resilience

When asked if resilience in disaster-prone or disaster-affected areas was a widely accepted goal in their work, five of six interviewees (with one interviewee not responding) agreed it was. At the same time, definitions of resilience varied amongst the interviewees, although the general theme that emerged was around resilience defined by social criterion. For example, “social cohesion,” “social capital,” “human capital,” and “participation and governance” were mentioned as avenues through which a community could increase its resilience. In particular, stakeholder empowerment, through opportunities for dialogue and the shifting of power structures, was seen as a key leverage point for building community resilience. Three interviewees also emphasized “natural resources,” “economic resources” and “increasing access to physical resources” as keys to resilience building. One interviewee thought resilience could be increase through the “removal of all conditions that undermine peoples’ capacity to meet their needs and defining success in terms of planet (ecosystem services) and people.”

iv. Measurement of Resilience - The 3Rs

The interviewees had similar ideas about the measurement of resilience in that it is difficult to achieve. For example, interviewees stated that: “[It is]
always a problem when it comes to measurement,” “the measurement piece is a contested area,” “[I am] not sure if it could be measured,” and “we don’t have a way to measure resilience.” Regarding the 3Rs theory adopted from the Norris et al. (2008) community resilience model, there was general acceptance of this method to access adaptive capacity from the three interviewees who addressed it, though with some additional comments. One interviewee thought the term ‘robustness’ was problematic, as “robustness refers to a system that is stable and does not change…. but, system change is needed for future development and future being of the system. A system has to change, fundamentally, to be resilient.” Another interviewee also emphasized that “the 3Rs should also apply to social capital not just to tangible resources.”

v. Additional Reflections about the Success Level

Most of the interviewees, five of six (with one not responding) agreed that resilience and sustainability belonged in the Success level of the framework and had nothing to add. However, four interviewees stated that “Success” was perhaps an inappropriate name for the second level of the framework. Suggestions of what to rename the level included “effective,” “sustainability” and “purpose.” One interviewee concluded, “Success of Pre-DRP is not the document, it’s the process.”

Secondary Research Question Number Three

What strategies should be considered to select actions for successful recovery in Pre-DRP?

i. Backcasting

Five out of five interviewees answered (with two not responding) that backcasting is an appropriate or realistic strategy to guide actions during Pre-DRP. One said it was “relevant” while another said, “it could be [useful].” There was general support for backcasting as a planning strategy because it supports the creation of a community vision for post-disaster recovery. One interviewee said that they “often see people developing visions in their line of work but these people often do not come back to the visions once they have been created.” Another interviewee echoed that statement by saying, “people vision, but then people tend to go on with
business as usual.” Another interviewee said, “yes, sure it is appropriate, but… you never can plan the future in a way that really turns out… so plans must be flexible, incremental and you must have resources that can be directed to other ends.”

ii. Forecasting

Five of six interviewees (the seventh did not respond) thought that forecasting was an appropriate planning strategy in the framework. For example, one interviewee said “forecasting is used more day to day,” and another said “forecasting is used more often that backcasting with the reason being forecasting is more aligned with the natural way humans think and plan.” However, one interviewee stated, “forecasting may not be particularly useful,” while another said, “forecasting is just now becoming a more popular strategy among planners within emergency management.”

iii. Prioritization Questions

Most interviewees said that the prioritization questions were appropriate to include in the Strategic level. The general theme that emerged was that there would be few things that would hinder planners to use the prioritization questions in their strategic action planning, with a few criticisms. For example, one interviewee stated, “the first three questions are great but the fourth seems to be a catch-all or an afterthought” while another interviewee said “they are fairly long.” Another interviewee stated, “an important factor when choosing appropriate interventions and actions is how planners actually engage with the community in the end.” It was also stated that a planner could best use the prioritization questions if there was “a high degree of social capital built up in the community.” One interviewee also said the prioritization questions might not be useful as, “if the people can choose for themselves what they want and how they will react, the officials can’t tell them what to do…”

iv. Strategic Guidelines

Interviewees gave varied comments about the strategic guidelines outlined in the framework. One interviewee advised to “check whether they are overlapping”, another thought that “preparedness as a strategy should be considered, while another interviewee thought that “appreciative inquiry… focusing on the positive things rather than negative things about a
community” might be a good addition. One interviewee suggested, “transparency could be paired with accountability.”

v. Other Feedback about the Strategic Level

Overall, interviewees claimed that backcasting, forecasting, the prioritization questions and strategic guidelines all fit into the Strategic Level. However, there were some outlying comments that were of particular importance. For example, one interviewee stated, “[you should] show how the strategic guidelines fit into planning strategies.” Another interviewee stated, “The only way any organization would push any of these recommendations would be if they were coming from the federal government or through the state. If there is no mandate or incentive to follow guidelines, they are usually ignored.” One interviewee also mentioned that the process of developing a Pre-DRP plan is a strategy on its own.

vi. Additional Comments About the Strategic Level:

Power

The general theme of power came up in many of the interviewees’ observations about community recovery. In particular, the power struggle between governments and communities was discussed as well as the empowerment of vulnerable communities as a key factor for Pre-DRP. For example, one interviewee said “governments want to keep power, structures… control” while another said “governments have certain agendas… so talking about getting the people involved does not always mean that others don’t lose power or influence.” Another interviewee said, “think about power and how power might exclude other people.”

Community Engagement/Participation

The theme of community engagement and participation as part of Pre-DRP was also popular among interviewees. The general theme that emerged was that an important factor in choosing appropriate interventions is how planners actually engage with the community members. For example, one interviewee stated, “what we tend to do in our participatory processes is we only tend to talk to the people that talk back to us, which leaves a lot out and creates unrealistic and ineffective responses… We need to make sure
that we get stakeholder buy-in in everything that we do, up front. If you come up with a plan without sharing it with interested stakeholders you probably won’t get that buy-in and it would probably get more push-back against it than you intend.” Another interviewee added, “being adaptive… is building partnerships and working very closely with the businesses and non-profits within the community… So instead of having little pockets of organizations all over trying to address needs we would work together to try to address them in a more streamlined capacity.”

**Overall Comments about the Framework**

Some additional comments were made about the overall framework:

- Two interviewees did not understand the logical flow between Systems, Success and Strategic levels and one suggested that a process chart be written to illustrate the usage of the framework.
- Three interviewees suggested that the academic, theoretical language used in the framework might be difficult for local planners to comprehend and should be simplified.
- Four interviewees emphasized the participation of relevant people in the planning process as the most important aspect of Pre-DRP.
- One interviewee mentioned that while pre-planning for disaster recovery is a good measure, it should also be noted that recovery will still involve ad hoc actions and that this should be accounted for during the planning process.
- One interviewee suggested that the framework would not apply as a template to any government in any pre-disaster situation and that it would be better to confine the intended audience (e.g. certain types of events or governments)
- Three interviewees also suggested that the framework should be further tested through a live application.

**3.3 Final Answer to the Primary Research Question**

The feedback collected from experts was analyzed according to thematic constructs and assessed against the preliminary results (the framework prototype). Corresponding changes were made to the framework prototype reflect the majority opinions. See Appendix D for the final framework result: the Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD).
Overall, the Pre-DRP FSSD was supported by experts and it was described as “heading in the right direction.” As a preliminary theoretical framework based only on data gathered from literature, it was praised for offering broad principles and being adaptable. The logical flow of the framework and how its elements fit together will have to become more serviceable, as SSD specific language was challenging for interviewees to understand. Therefore, the final, revised version of the Pre-DRP FSSD includes revisions to SSD language to aid comprehension for the intended audience of the framework (Pre-DRP planners). As the researchers expected, some of the interviewees commented on the need to test the Pre-DRP FSSD in a live situation, in order to test its validity.

3.3.1 Modifications made to the Pre-DRP FSSD

Modifications made to the Pre-DRP FSSD prototype are included in this section. The changes made were based on new ideas and material encountered by the researchers after the framework prototype was created as well as the feedback gathered from expert interviews. These changes resulted in the final Pre-DRP FSSD model, which can be seen in Appendix D.

A statement about how a Pre-DR plan must be flexible because a plan may not always be useable as a post-disaster recovery strategy was added to the opening description of the framework. The question of how to best incorporate flexibility into a plan or how to abandon a Pre-DR plan should the occasion arise remains to be explored.

Systems Level

The main changes made to the Systems level are listed below:

- Adaptive capacity was removed as a subsystem since it is a quality that can be ascribed collectively to the main overall system, the biosphere, and its subsystems of society and community. Adaptive capacity, and the determinants that influence it, are now described as a component of resilience in the Success level.
- Further explanation was added about what Society entails. Society is now broken down into the subcategories of economy, politics, culture, and technology.
• The description of Community was expanded. Community now includes the elements: resources; institutions like governance structures, social networks, and businesses; and individuals who usually share similar cultural norms and values. This clarification came about since a few experts had to assume that we were including certain factors (e.g. economical and social) within the subsystem of Community.

• Also, human needs (as defined by Max Neef) were added to the Community subsystem to provide awareness of the significant role that local context has on need satisfiers and the importance of individuals and their interactions as part of stakeholder inclusivity. This was done because an interviewee emphasized that “needs and beliefs and fulfillment of needs are formed at this level and adaptation, coping, mitigation mainly takes place there.”

• Biosphere is no longer described as a subsystem. Now it is the overarching system and whatever is beyond it is not included.

**Success Level:**

The main changes made to the Success level are listed below:

• The name of the Success level was changed to “Successful Outcomes” upon realization that the word Success, at first glance, was often seen as an inappropriate word to use in the disaster management field due to the tragedy that communities may incur.

• Clearer examples of what the SPs connote were given due to their central importance within the Pre-DRP FSSD.

• Due to its relevance to communities facing unpredictable disaster scenarios, adaptive capacity is clarified as a critical component of the umbrella concept of ‘resilience’. The determinants of adaptive capacity are now described as leverage points, and examples are given.

**Strategic Level:**

The main changes made to the Strategic level are listed below:

• An expansion of the backcasting definition was added in order to quell misunderstanding of the term.
• An expansion of the forecasting definition was added in order to prevent misunderstandings and to more clearly distinguish it from backcasting.
• Transparency was coupled with Accountability within the Strategic Guidelines, as one interviewee had suggested.
• The fourth Prioritization Question was rephrased to add clarity.
4 Discussion

In this section, the researchers interpreted and reflected on the key findings of the results and how they contributed to the refinement of the framework. Flow of the discussion is organized according to the three secondary research questions, the primary research question, and thoughts on the application, limitations, strengths of the Pre-DRP FSSD. Areas for further research are also discussed.

4.1 Reflections on the Systems Level

4.1.1 The Biosphere, Society and Community

As the results show, the interviewees generally agreed that the Systems level of the Pre-DRP FSSD is the biosphere, and its nested subsystems, are society and community. Feedback on the way these elements were described mainly showed that more clarification about terms was needed. In turn, this allowed the researchers to understand that clarification of terms was the most significant change needed to the Systems level of the prototype. Subsequently, the researchers revised phrasing to explicitly state that the biosphere comprised the overall system. This distinction is critical since the Systems level outlines the conditions for the Sustainability Principles in the Success level. Furthermore, subcategories of economy, politics, culture, and technology were added to the societal subsystem in order to describe society in more detail. This was done at the suggestion of several interviewees to distinguish political and economic threads as these factors greatly influence the recovery process and actors within each of these groupings tend to apply conflicting pressures on the community. Similarly, more emphasis on the individual within the community subsystem was deemed important and so the incorporation of Max Neef’s human needs theory helped to fill this gap.

4.1.2 Adaptive Capacity

The concept of adaptive capacity has likely been the most controversial topic around the construction of the Pre-DRP FSSD. Adaptive capacity is a term based in the emerging field of resilience science, though like sustainability, a variety of definitions cloud it’s meaning. The researchers felt strongly that it should be included in the framework because
adaptability plays a fundamental role in recovery and risk reduction. This fundamental role derives from the understanding that following a disaster a community must adapt to find a new level of stability as well as eradicate the previous vulnerabilities that contributed to the disaster in the first place. The interviewees were also in general agreement that adaptive capacity belonged in the Pre-DRP FSSD, but questioned which level it belongs in. Most were confused by its inclusion in the Systems level so it was moved into Successful Outcomes in the revised framework to better describe the means to achieve resilience. Examples of the determinants of adaptive capacity were also included as leverage points within the community subsystem.

4.2 Reflections on the Successful Outcomes Level

4.2.1 Sustainability

As disaster management has evolved to be more proactive than reactive, a growing wealth of literature advocates ‘sustainability’ as a common disaster recovery goal. The interviewees in this study echoed this sentiment by showing support for sustainability as part of the Success level of the Pre-DRP FSSD. Though the general concept was embraced, scrutiny fell on the way sustainability was defined. Many found the SPs to be abstract and difficult to operationalize within the context of recovery. Yet, various meanings of sustainability are used throughout the field of disaster management. The fact that there is no unified or commonly held definition makes it difficult to set strategic goals around this concept. For this reason, the scientifically rigorous SPs are a suitable foundation for an analytical planning process like Pre-DRP. Since the main purpose of the framework is to move communities and society towards sustainability, the task for the researchers was to make the SPs more accessible to users. Adding context linking disasters to the sustainability challenge and disaster risk reduction to sustainable development and perhaps including a tutorial for the FSSD could improve the comprehension and operationalization of the SPs.

4.2.2 Resilience

Considered relevant by most of the interviewees, resilience is, and increasingly will be, an important concept to consider in disaster management. It captures a community’s desire to return to some degree of
stability and to be better equipped to absorb future shocks. Because there is no commonly used measurement of resilience in disaster management, the researchers adopted the 3Rs theory, promoted by Norris et al. (2008) because the 3Rs allow planners to assess resilience through adaptive capacity in a concrete way. There was general support among the interviewees to keep the 3Rs in the Pre-DRP FSSD, but the researchers also asked interviewees about other, more suitable, benchmarks for resilience. Most of the experts were unsure if a better method existed or if it could be done at all, with the exception of one interviewee who suggested adapting Elinor Ostrom’s eight “design principles” of stable local common pool resource management, a guide for managing ecosystems to maintain long-term sustainable natural resource yields. The researchers agree that this theory for governance of the commons could be very useful in increasing the resilience of the ecological system since the intent of these principles is “to enhance the robustness of a SES” through a “focus on governance that enhances the resilience of an ecosystem configuration that produces a desirable bundle of goods and services” (Anderies, Janssen and Ostrom 2004, 1-2). The researchers’ initial impressions were that Ostrom’s design principles could be incorporated into the framework as principles for developing the ‘robustness’ component of the 3Rs theory, however, greater exploration of this possibility extends outside of the current research scope and will be a recommendation for a future study. Ultimately, as resilience gains more attention as a science, perhaps better mechanisms for measuring it, particularly its component of adaptive capacity, could be applicable to the Pre-DRP FSSD in the future.

4.2.3 Resilience and Sustainability

Within the Success level of the Pre-DRP FSSD, resilience and sustainability are distinguished as two separate goals. What was taken from speaking with the experts was the notion that resilience and sustainability may serve to evolve each other and that one may be a measure of or even contribute to the other, i.e., in a Pre-DRP context, a high level of resilience may enhance sustainability and/or vice versa. This convergence was also supported by a strong consensus in the literature regarding the link between the two concepts. Though they share a degree of reciprocity, both must be included in the Pre-DRP as goals since they address different levels within the system. To explain, a tree metaphor: may represent both sustainability and resilience, where the trunk and branches represent the system’s core principles (sustainability as defined by the Sustainability Principles) and the leaves represent other details. Like the unyielding trunk and branches of
a tree, sustainability relates to the steady-state of SES conditions. Resilience, on the other hand, is about dynamic response within the context of complexity and uncertainty as represented by the leaves. It also concerns the ever-changing conditions of the SES that can generate hazards and disasters. Resilience joins sustainability within the Successful Outcomes level of the framework because though sustainable development may increase resilience, it cannot fully inform the development to resist disasters.

4.3 Reflections on the Strategic Level

4.3.1 Backcasting and Forecasting

The Strategic level of the Pre-DRP was the least revised level of the prototype framework as compared with the Systems and Successful Outcomes levels. The planning methods of forecasting and backcasting, were familiar to most of the interviewees, and needed only minor semantic revisions to make them more clear. Though they were understandable and observed as relevant, backcasting was challenged around its promotion and follow-through since many of the interviewees indicated that it is underutilized in practice. The inclusion of backcasting in the Pre-DRP FSSD could increase the adoption of this type of planning method in Pre-DRP.

4.3.2 Prioritization Questions

Despite some changes to semantics, the Prioritization Questions remained the same in the refined Pre-DRP FSSD. They were perceived to be useful in their attempt to keep the priorities outlined in the Successful Outcome level at the forefront of the decision-making process when evaluating measures in terms of tradeoffs.

4.3.3 Strategic Guidelines

Most of the basis for the Strategic Guidelines proposed in this level were drawn from actual Pre-DR plans or theories regarding their development in the literature review. Some of them, like Holism, Flexibility and part of Transparency and Accountability stemmed from the researchers’ own conclusions. The guidelines represent the main considerations or good
practices that planners should keep in mind when developing Pre-DR plans. With the exception of one constructive comment, feedback from the interviewees about the guidelines was generally positive, however, it is the researchers’ conviction that these results are inconclusive due to the number of guidelines and the limited time that was allocated to their analysis during the interviews. A study dedicated solely to the evaluation of these guidelines is needed to gauge their applicability and to garner more constructive feedback for their refinement.

4.4 The Framework Structure

Based on the interviewees’ comments surrounding the importance of community engagement and participation during the planning process, it is noted that Pre-DR plans are inherently context specific. This supports our decision to not include tools and actions levels in the Pre-DRP FSSD as to include suggested tools would have required the researchers to take into account factors including local history, beliefs and practices. It was very interesting to hear interviewees give examples of how greater society functions as a supplement for services and resources that have broken down in communities after a disaster. This gave bearing to one of the aims of the Pre-DRP FSSD, which calls for strengthening the adaptive capacity in society in order to serve connected, disaster-affected communities.

4.5 Scope and Application of the Pre-DRP FSSD

The degree of usefulness of the Pre-DRP FSSD may vary across users. As one of the interviewees pointed out, using such a broad framework at a very local level would be difficult due to a lack of specific details. The same interviewee also felt that more explanation is needed on how to actually implement the framework. Perhaps the Pre-DRP FSSD would be more user friendly if its scope was narrowed down or based on a specific context or region (e.g. the Pre-DRP FSSD-Developing Country or the Pre-DRP FSSD-Mongolia). The researchers have considered these recommendations and have determined to adhere to their original intent for the framework to remain general, much like the FSSD. Indeed, it is this broadness that is one of its strengths when the sheer complexity inherent in recovery scenarios is considered. Planners can take this framework as a baseline and tailor it to the specific context of their community. The Pre-DRP FSSD is intended to
be the starting point of the planning process for recovery that promotes the systems perspective typically lacking in disaster management. In fact, several interviewees told the researchers that recovery issues faced by communities are often viewed in isolation and the interactions and interconnectedness of these individual issues are not fully understood, a position also supported in the literature. This framework can be useful in generating ‘big-picture’ dialogue between actors in order to connect short-term recovery activities with long-term recovery goals. It is the process, not the plan, that is the most critical product of the Pre-DRP FSSD, as it helps to build bridges between stakeholders as well as to promote sustainability and resilience building in the community.

4.6 Limitations of the Pre-DRP FSSD

Interestingly, the world of Pre-DRP for anthropogenic disasters is different that Pre-DRP for natural disasters. There is a much wider scope to Pre-DRP plans for terrorist caused disasters as there is no way to predict the type, severity or location of the attack. However, the type, severity and location of many natural disasters can be forecasted. This difference highlights a limitation of the Pre-DRP FSSD, as it is suited only to planning scenarios where hazard events can be somewhat forecasted.

4.7 Discussion of Research Limitation and Strengths

The main limitations of this study were its short research period and restricted access to academic resources (e.g. access to online journal articles through our university’s limited subscription). To explain, disaster management is a broad subject and the researchers’ collective lack of knowledge about Pre-DRP was a hindrance with respect to the short-term nature of the research period. The short research period also limited the ability to test the Pre-DRP FSSD in an applied planning context, which could have offered it more vigor. In addition, research about Pre-DRP has been slow to emerge, which meant that finding literature directly related to Pre-DRP was often difficult with limited online access to resources.

The research sample population was also relatively small due to limited time for the data collection phase. However, the sample covered a wide
range of expertise and viewpoints from several countries which strengthens the Pre-DRP FSSD’s robustness.

Given the limited access to interviewees and the breadth of the concepts to be tested in the prototype of the Pre-DRP Framework, the opportunity to work through each one in detail was lacking. For instance, perhaps the difference between forecasting and backcasting was not explained well enough in the interviews. Several interviewees seemed to misunderstand the nuances of the concepts and this led to convoluted feedback. Although “backcasting” was explained, some interviewees misinterpreted the strategy simply because they were not familiar with the name. In one instance, a interviewee inquired if backcasting was the same as “hindcasting,” to which the researchers erroneously answered “yes.” The interviewee then answered “no” when asked if backcasting was a strategy she used. This type of misinformation also occurred when a different interviewee asked if backcasting was same as “reverse engineering.”

The interview could have served to get more detailed information regarding each construct within the Systems level. By asking one question concerning the relevance of all 3 (biosphere, society and community), getting information strictly on one of the constructs was difficult. If each was given its own separate question, stronger feedback might have been acquired. Similarly, a direct question surrounding the usefulness of the 3Rs as a measure of resilience would have been helpful. The researchers did not expect to encounter a lack of feedback about the measurement of resilience.

On the other hand, this research presents a new perspective within the literature surrounding Pre-DRP as well as Strategic Sustainable Development. Despite the limitations mentioned above, a fair range of expert opinions were gathered that were relevant to the research questions.

4.8 Future of Pre-DRP FSSD and Suggested Further Research

Ideally, a practical application of the framework by a local government’s emergency planning division would highlight the weaknesses and strengths of the Pre-DRP FSSD. However, the Pre-DRP FSSD will need to be tested in a real context in order to prove its own robustness and utility.
One item still under consideration is whether the elements of local beliefs and traditional knowledge systems can or should be included within each level of the Pre-DRP FSSD. Perhaps these concepts could be explored in further research related to the framework.

The Pre-DRP FSSD can offer practitioners a scientifically robust definition of sustainability in order to align actions of the wide range of stakeholders involved to best serve the communities. It can also offer an adaptable measure of resilience to monitor progress towards success. Further exploration of the relationship between resilience and sustainability as defined by the four Sustainability Principles would be an enticing area of further research. In addition, whether a strategic sustainable development approach could help build a measure of resilience within disaster-prone communities could also be explored in further research. As one interviewee pointed out, the integration of DRR into the recovery processes is a current area of focus. How SSD can improve the DRR process is certainly an area available for further research.

Due to the limited breadth of Pre-DRP research, there is ample room for this field to grow. Even in the last days of the research period, new concepts and issues were brought to light (e.g., incorporating a business case for resilience to entice governments to implement the Pre-DRP FSSD) which highlights the fact that there are many opportunities for SSD to advance the field of disaster management.
5 Conclusion

Within our changing world, phenomena such as global warming and the growing divide between rich and poor will cause increased vulnerability to hazards within communities worldwide. Our concern for the natural environment grows as urban populations swell, with Earth forecasted to support almost 10 billion inhabitants in less that 50 years from now. The number of disaster events are also increasing due to anthropogenic effects on the global climate and our most vulnerable populations will be subjected to an increasing number of disturbances. The ecological system is under threat from our current consumption needs and the ecosystem services it provides us will become ever more valuable as they disappear, urging us to strive for sustainability starting now.

Pre-disaster recovery planning (Pre-DRP) is a field within disaster management that is under researched, although interest in this emerging tactic is peaking with greater emphasis on proactive versus reactive planning. Pre-DRP for post-disaster recovery offers an unprecedented opportunity for implementing full sustainability initiatives into human societies at the community level, which will save governments money and resources in the long term. The diverse field of actors involved during the recovery phase of a natural disaster presents on-going stakeholder communication and power equity challenges that need to be addressed.

The Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD) introduced in this thesis can improve pre-disaster planning for post-disaster recovery by:

- offering guiding principles that divert traditional problems within DM coordination towards sustainable actions
- offering/suggesting the DM world a measure of resilience that is easily transferable to various situations
- framing Pre-DRP using a systems perspective in order to facilitate the inclusion of actions toward sustainability leading society to build back better
- offering strategic guidelines that cover the range of considerations needed to ensure healthy/fair coordination of resources
- Being flexible/broad enough for local users to adapt the contents of their Pre-DRP plan depending on context
The research within this thesis would be best supported by the actual implementation of the Pre-DRP FSSD by differing levels of government, to allow for the creation of case studies to access and discern its weaknesses, strengths and overall robustness. The Pre-DRP FSSD must be tested in a variety of situations (ex, a developed Spanish speaking nation prone to hurricanes and a developing English speaking nation prone to earthquakes) in order to evaluate the effectiveness of the general nature of the framework as it is applied. Another area for further research would be to investigate how preparedness and mitigation strategies can support the usefulness of the Pre-DRP FSSD and/or vice versa. With many opportunities for the Pre-DRP and the field of SSD to advance the other, the researchers would like to see more research done in this area plan to carry it forth into their future work.
References


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Norris, Fran H., Susan P. Stevens, Betty Pfefferbaum, Karen F. Wyche and Rose L. Pfefferbaum. 2008. Community resilience as a metaphor, theory,


Appendix A
Tool Prototype

Summary
Supporting the aims of the Hyogo Framework for Action 2005-2015 (HFA), the Pre-DRP FSSD is a planning tool to guide strategic preparation and post-disaster recovery activities, in an effort to mitigate risks and help society build back sustainably, toward an overall goal of improved community resilience.

Aims:
1) Enhance the resilience of a community so that the threat of a natural hazard event becoming a disaster is mitigated; and failing that, in the event that a disaster does occur:
2) Ensure that the community has developed an effective network of crisis assistance within greater society, upon which the community can depend if local capacities become overwhelmed, and;
3) Develop local capacities to aid the rehabilitation of surrounding, affected communities as a way of building mutual, regional resilience; and
4) Enhance the speed and effectiveness of the recovery process by bringing stakeholders together to build a vision for community renewal through sustainable development and resilience building.

Systems Level
The socio-ecological system (SES) is viewed to behave as a complex adaptive system, “in which many agents, elements, and subsystems interact in densely connected networks” (Espinosa and Porter 2011, 56). To explain, human society is embedded in the biosphere and communities form subsystems within society (refer to Figure 2 for descriptions). Society depends on ecosystem services from the biosphere to function including clean air, fresh water stocks, shoreline and erosion protection, and biological diversity, etc. All of these subsystems are integral components to be considered in Pre-DRP as it occurs within the global SES.
Community Adaptive Capacity

In the Pre-DRP FSSD, community resilience is expressed by the adaptive capacities attributed to a community. **Adaptive capacities** are defined as “resources with dynamic attributes” that allow for the absorption of a disturbance or adversity; or impart the ability to adapt to changed system conditions (Norris et al. 2008, 135). Adaptive capacities are positively related to the endowments of resources available to the community (ABARE–BRS 2010), but they can also include important intangible processes (Jones, Ludi, and Levine 2010). In the Pre-DRP FSSD, adaptive capacities relevant to the community subsystem interconnect and overlap in complex ways, and to facilitate their comprehension, have been
organized into 5 categories (illustrated in yellow in Figure 3). The categories of adaptive capacities are shown extending beyond the community to reflect dependence on greater society and the important role that external actors play in community recovery.

Success Level
The desired outcome of an implemented disaster recovery plan, according to the success level of the Pre-DRP FSSD, is two-fold:

- First, the community will move toward **compliance with the four sustainability principles** which state that, in a sustainable society, nature is not subject to systematically increasing:
  1. concentrations of substances extracted from the earth's crust
  2. concentrations of substances produced by society
  3. degradation by physical means
  4. and, in that society, people are not subject to conditions that systemically undermine their capacity to meet their needs.

- Second, the community is more **resilient**, meaning that the quantity and quality of its adaptive capacities will have improved as measured by the **3Rs**, three dynamic attributes of a resource defined as:
  - **Robustness** - “the resource strength, in combination with a low probability of resource deterioration”
  - **Redundancy** - “the extent to which elements are substitutable in the event of disruption or degradation”;
  - **Rapidity** - “how quickly the resource can be accessed and used (mobilized)” (Norris et. al 2008, 131).

Success in the Pre-DRP FSSD is visually represented in Figure 4. Society is bound by the four sustainability principles (in red) to convey that, in a sustainable future, humanity will operate within these socio-ecological constraints.

At the core of success of the Pre-DRP FSSD are the 5 categories of adaptive capacities to represent community
resilience. In line with Norris et al.’s (2008) reflection on Bruneau et al.’s (2003) resilience-resources theory, to engender resilience, adaptive capacities must achieve at least one of three dynamic properties: robustness, redundancy, and rapidity (the 3Rs). The 3Rs help us measure community resiliency within the five spheres as they essentially determine the ability of the community to adapt to new system conditions. The more developed the adaptive capacities according to these qualities, the easier it is for a community to adapt and return to a normal or altered state of functioning in the post-disaster recovery phase. Ideally, a community would adapt in a way that would allow it to “build back better”, to become more sustainable and increase its resiliency.

**Strategic Level**
The Strategic level includes guidelines to help Pre-DR planners choose strategic actions that will move their community towards Success. One method, Backcasting from a principles-based vision of success can guide strategic planning and inform the creative tension between an envisioned future and present reality. Decision makers can use the Pre-DRP FSSD to determine strategic actions that will lead to their goals and they can employ prioritization questions to evaluate their strategy (see list below). Complimentarily, forecasting, as a method of plotting necessary steps to be taken in order to reach a vision of success, can be highly useful in Pre-DRP since much of the current Pre-DRP knowledge has been gained by lessons learned from past disasters.

Additionally, brainstormed measures within the Pre-DR plan should be evaluated and ordered according to their contributions to Success. Guiding considerations for the prioritization of actions for a strategic Pre-DRPFSSD include:

1. Do the measures enhance community adaptive capacities toward resilience?
2. Do the measures maneuver the community and society closer to compliance with the sustainability principles?
3. Do the measures function as a flexible platform for future advancements toward compliance with the principles?
4. Are the measures likely to catalyze further progress in other aspects of the recovery process?

In addition to these considerations, Table 3 presents guidelines of that are
designed to help Pre-DRP FSSD users eliminate barriers to success. These strategic recommendations have been influenced by a variety of literature (Sinha 2008; NDRF 2010; McEntire, Crocker and Peters 2010) and are intended to help users lay the groundwork for resilience and sustainability during post-disaster recovery.

Table 3. Strategic Guidelines of the Pre-DRP FSSD

| Local Primacy | Local governments have the primary authority and responsibility to direct recovery efforts with the support of national governments, if needed. |
| Inclusiveness and empowerment | Pre-DR plans should target the participation and commitment of all stakeholders included in recovery, especially marginalized groups in society. |
| Multi-sectoral coordination | Rich networks of community-based organizations and stakeholders should be developed and the roles and responsibilities of these actors clearly defined. |
| Transparency | Clear communication pathways should be developed to relay information through a process that is inclusive of and accessible to the general public and stakeholders. |
| Holism | Pre-DR plans should maintain a systems thinking perspective. Embracing profound system dynamism as a feature of the system of inquiry promotes creative adaptations towards resilience and sustainability rather than trying to force a return to pre-disaster normalcy (and its inherent vulnerability). In order for a Pre-DR Plan to be adapted to a community, certain context-specific features such as hazard risks, strategic relationships, and resource stocks and flows need to be considered in the systems level. |
| Mitigation | Pre-DR plans should incorporate hazard risk reduction and development challenges, and use lessons learned from prior disasters to forecast future threats/challenges. |
| Flexible | Actors of the plan are provided a degree of flexibility in the design of their roles to meet evolving recovery needs. |
| Build Back Better (BBB) | Guiding approach to ensure the community is built back to be resilient to the next disaster instead of building back the pre-existing vulnerabilities. |
# Appendix B
## List of Experts

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
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<tbody>
<tr>
<td>Amanda Phan</td>
<td>Emergency Planner</td>
<td>Fairfax County Office of Emergency Management</td>
</tr>
<tr>
<td>Claire B. Rubin</td>
<td>Recovery Practitioner/President</td>
<td>Claire B. Rubin &amp; Associates</td>
</tr>
<tr>
<td>Daniel F. Lorenz</td>
<td>Research Associate</td>
<td>Disaster Research Center (KFS) Institute of Social Sciences – Christian-Albrechts University</td>
</tr>
<tr>
<td>Mike Weickert</td>
<td>Strategy Leader for Disaster Management - Program Strategy Department, International &amp; Canadian Programs</td>
<td>World Vision Canada</td>
</tr>
<tr>
<td>Stanley Nyoni</td>
<td>Senior Sustainability Advisor</td>
<td>The Natural Step</td>
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<tr>
<td>Dr. Will Allen</td>
<td>Independent Consultant &amp; Action Researcher</td>
<td><a href="http://www.learningforsustainability.net">www.learningforsustainability.net</a></td>
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Appendix C
Interview Schedule

Masters in Strategic Leadership towards Sustainability Thesis
Questionnaire
Blekinge Institute of Technology
Alicia Livitt, Kirstin Piirtoniemi & Danielle Hiscock

Pre-DRP FSSD Survey Questionnaire
Purpose: to gain feedback on our conceptual framework, the Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD) which pertains to identifying disaster mitigation activities as well as activities that would occur in the post-disaster recovery phase after a natural hazard event. It is intended to guide the development of pre-disaster recovery plans during the preparation/preparedness phase of disaster management.

Background
Through our research and conversations with our external partner, the International Recovery Platform Secretariat in Kobe, Japan, and sustainability professionals from The Natural Step organization, we have come to realize that pre-disaster recovery planning (Pre-DRP) is an integral part of disaster risk reduction and that it provides opportunities to embed sustainability into recovery activities. Pre-DRP is the process of planning for the recovery phase before a disaster happens. Its purpose is to provide insights and guidelines to support post-disaster recovery operations and to reduce vulnerability to future risks through mitigation activities. As master’s students, we have created a conceptual framework for pre-disaster recovery planning that is based on resilience science and a tool called the Framework for Strategic Sustainable Development (FSSD).

We would like the scope of the Pre-DRP FSSD to remain broad enough that any government in any region of the world could use it to develop a Pre-DR plan.

Purpose of the Pre-DRP FSSD
The Pre-DRP FSSD is a planning framework intended to guide strategic preparation and post-disaster recovery activities in an effort to mitigate risks and help society build back sustainably, toward an overall goal of improved community resilience.
The aims of the Pre-DRP FSSD are to help governments develop Pre-DR plans that will:

1) Enhance the resilience of a community so that the threat of a natural hazard event becoming a disaster is mitigated; and failing that, in the event that a disaster does occur:
2) Ensure that the community has developed an effective network of crisis assistance within greater society, upon which the community can depend if local capacities become overwhelmed, and;
3) Develop local capacities to aid the rehabilitation of surrounding, affected communities as a way of building mutual, regional resilience; and
4) Enhance the speed and effectiveness of the recovery process by bringing stakeholders together to build a vision for community renewal through sustainable development and resilience building.

In our research we are specifically interested in determining what content should be included in the Systems, Success, and Strategic levels of our framework (see Figure 1). Two additional levels, Actions and Tools, are not included in this questionnaire due to their context-specific nature.

![Figure 1 – Top 3 levels of the Pre-DRP FSSD (Actions and Tools levels not shown)](image)

**Instructions**
A brief explanation of each level within the Pre-DRP FSSD will be given followed by the content that we think comprises that level (based mainly on literature review). Relevant questions are presented after the level contents and are italicized. Please insert your answers directly after each italicized question after the text prompt in blue (ie. *Answer*).
**Interviewee Identification Information**

Your name: [Answer]  
Organization/employer: [Answer]  
Title and brief job description: [Answer]

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**Systems Level** refers to the system elements that are relevant to the overall goal of Pre-DRP.

We define the **socio-ecological system** as the overall system in which disasters occur, and within it, we think the following **subsystems** are relevant to Pre-DRP and sustainability:

- **The Biosphere**
  - I.e. the global ecological system that provides ecosystem services that society depends on.
- **Society**
  - I.e. external actors who provide human, physical and financial capital to disaster affected communities/nations (governments, NGOs, etc.)
- **Communities**
  - I.e. the focal group of recovery activities.
- **Adaptive Capacities**
  - I.e. the tangible and intangible resources that enable a community to adapt to system disturbances

**Questions about the Systems Level**

A) **With respect to the systems that we have outlined (biosphere, society, community, adaptive capacities) can you provide some specific examples of where they are or have been relevant to your work in resilience, disaster risk reduction or Pre-DRP?** [Answer]

B) **Of all the systems outlined above, which one(s) receive the most attention in your line of work? How are they emphasized?** [Answer]

C) **Do you think that any of the systems we have outlined do not belong in the Systems Level? Which one(s)?** [Answer]

D) **Are there other subsystems that you think are important to add to the Systems Level? What are they?** [Answer]
Success Level outlines the overall goal or purpose of the pre-disaster recovery planning process. We describe Success in Pre-DRP as two things:

1) First, Success means that society is in compliance with the four Sustainability Principles (SPs), which represent sustainable development. The first three principles present the necessary conditions for ecological sustainability while the fourth defines what is necessary for social sustainability. In their commonly cited form, the four SPs state that in a sustainable society (i.e. in order for society to move towards sustainability), nature is not subject to systematically increasing:
   1. Concentrations of substances extracted from the earth's crust (e.g. fossil fuels);
   2. Concentrations of substances produced by society (e.g. CFCs);
   3. Degradation by physical means (e.g. deforestation or landfill); and
   4. In that society, people are not subject to conditions that systemically undermine their capacity to meet their needs (e.g. have enough to eat; work in fair conditions)

2) Second, Success means that a community will increase its resilience to disaster risks through strengthening its adaptive capacities (ability to adapt to new system conditions). To engender resilience, adaptive capacities must achieve at least one of three dynamic properties as outlined by Norris et. al: robustness, redundancy, and rapidity (the 3Rs).
   i. Robustness refers to “resource strength, in combination with a low probability of resource deterioration”
   ii. Redundancy refers to “the extent to which elements are substitutable in the event of disruption or degradation”; and;
   iii. Rapidity refers to “how quickly the resource can be accessed and used (mobilized)”

Questions about the Success Level

E) How is sustainability relevant to your current work (i.e. projects, programmes, research, advocacy, and/or action that you may be involved in)? [Answer]

F) Do you/does your organization use a formal definition of
sustainability? If so, how is it defined? [Answer]

G) To what extent do you think sustainability as defined by the four Sustainability Principles is an achievable or realistic definition of success in disaster recovery (Pre-DRP)? [Answer]

H) Do you/does your organization use a formal definition of resilience? If so, how is it defined? [Answer]

I) Would you say that the following statement is true? - “Resilience does not necessarily equal sustainable development, but sustainable development equals resilience.” Please explain the reasoning behind your answer. [Answer]

J) Is increased resilience in disaster-prone or disaster-affected communities a widely accepted goal in your line of work? [Answer]

K) In your opinion, how can a community best increase its resilience? [Answer]

L) How can resilience best be measured? What might be some the pros and cons of using that form of measurement? [Answer]

M) We think that resilience can be increased through strengthening adaptive capacities. How does this concept of resilience compare with your own or your organization’s concept of resilience? What are the differences or similarities? [Answer]

N) We think that organizing adaptive capacities into broad categories (e.g. social, cultural, governance, physical, economic) could help explain how resilience is increased in different parts of a community. Do you think this type of categorization could clarify the concept of adaptive capacities? [Answer]

O) Do you think any criteria should be added to/removed from the Success Level? If so, which one(s) would you add or remove? [Answer]

**Strategic Level** guidelines help Pre-DR planners choose strategic actions that will move their community towards Success. In the Pre-DRP FSSD, we think that the Strategic Level should include the following:

1. **Planning Strategies:**
   - Backcasting from the success principles; i.e. asking what do I need to do today to get my community to where I want it to be in the future (i.e. sustainable and resilient)?
   - **Forecasting** future outcomes based on current trends
   - Analyzing brainstormed actions through 4 **prioritization**
questions, which include:

1. Do the measures enhance community adaptive capacities toward resilience?
2. Do the measures maneuver the community and society closer to compliance with the Sustainability Principles?
3. Do the measures function as a flexible platform for future advancements toward compliance with the Sustainability Principles?
4. Are the measures likely to catalyze further progress in other aspects of the recovery process?

2. Strategic Guidelines:

- **Local Primacy**: local governments have the primary authority and responsibility to direct recovery efforts with the support of national governments, if needed.
- **Inclusiveness and Empowerment**: the participation and commitment of all stakeholders is included in recovery, especially marginalized groups in society.
- **Multi-sector Coordination**: rich networks of community-based organizations and stakeholders should be developed and roles and responsibilities clearly defined.
- **Holism and Awareness**: a complex adaptive systems (CAS) perspective is used to improve the analysis of long-term consequences of immediate actions. Plans incorporate awareness mapping of available aid, funding, knowledge, skills, and technical expertise of local and external recovery actors.
- **Mitigation**: plans incorporate hazard risk reduction and development challenges, and use lessons learned from prior disasters to forecast future threats/challenges.
- **Transparency**: clear communication pathways are developed to make information sharing inclusive and accessible to all stakeholders.
- **Flexible and Dynamic**: actors of the plan are provided a degree of flexibility in the design of their roles to meet evolving recovery needs.
- **Build Back Better**: guiding approach to ensure the community is built back to be resilient to the next disaster instead of building back the pre-existing vulnerabilities.
Questions about the Strategic Level

• Have you ever used backcasting as a strategic planning method in your work (perhaps under a different name)? When did you use it and why did you use it? [Answer]
• Do you think that backcasting is an appropriate or realistic strategy to help guide actions towards Success in Pre-DRP? Please explain your answer using an example from your past work experience. [Answer]
• Do you use forecasting as a strategic planning method in your work? When and why do you use it? [Answer]
• What might motivate or hinder a planner from using the 4 prioritization questions to choose actions in a Pre-DR plan? Is there a prioritization question that you would like to see added or removed? [Answer]
• (If applicable) To your best knowledge, are the strategic guidelines that we have outlined general enough to be used by governments all over the world? Are there any guidelines that you would specifically add to or remove from the list? [Answer]
• (If applicable) what strategic guidelines are used by your organization to guide post-disaster recovery actions? Can you elaborate on the effectiveness of using guidelines to decide strategic actions based on a past work experience? [Answer]

General Questions

• What is your overall, general impression of the Pre-DRP FSSD? [Answer]
• Is there anything you would like to add/remove from the Pre-DRP FSSD? [Answer]
• (If applicable) In your opinion, what elements of post-disaster recovery operations should be considered in a pre-disaster recovery plan? [Answer]
• Are you familiar with any tools that might help implement or measure the progress of a Pre-DR plan? What are they and how can we find more information about them? [Answer]
• Do you have any additional comments or questions? [Answer]
Appendix D
The Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD)

Pre-Disaster Recovery Planning
Pre-disaster recovery planning (Pre-DRP) is the process of planning for the recovery phase before a disaster happens. Its purpose is to provide insights and guidelines to support post-disaster recovery operations and to reduce vulnerability to future risks. Pre-DRP is not yet widely practiced, but those who support it generally consider Pre-DRP a necessary part of disaster risk reduction and a key component of the ‘build back better’ (BBB) approach to recovery (Sinha 2008). It effectively supports the aims of the Hyogo Framework for Action 2005-2015 (HFA), which emphasizes building the resilience of nations and communities through systematic actions to address disaster risk reduction in the context of sustainable development (UNISDR 2005).

The Pre-DRP FSSD
The Pre-Disaster Recovery Planning Framework for Strategic Sustainable Development (Pre-DRP FSSD) is a theoretical guide for Pre-DR planners that supports sustainable development and community resilience building. It emphasizes that planning for disaster recovery presents an opportunity to identify and dismantle barriers to sustainability and resilience, through a strategic and holistic plan of action. Specifically, it directs users to conduct recovery planning from a systems perspective, identify overarching goals for post-disaster recovery outcomes, and strategically choose actions and tools that may be useful during the post-disaster recovery phase. As Pre-DRP is done during the preparedness phase of disaster management, it also allows local planners to identify and implement strategic preparation activities to reduce disaster risks before a natural hazard event. The scope of the Pre-DRP FSSD is broad so that any national, regional or local government can use it as a template for their recovery planning process. Planners are expected to use context-specific information in addition to the Pre-DRP FSSD in order to create a fully comprehensible Pre-DR plan. It is also recommended that planners use the ABCD strategic planning process as outlined by Ny et al. (2006) to formulate their Pre-DR plan.

Aims of the Pre-DRP FSSD
The Pre-DRP FSSD has four main aims, which are to:
1) Enhance the resilience of a community so that the threat of a natural
disaster is mitigated; failing that, in the event that a disaster does occur:
2) Ensure that the community has developed an effective network of crisis assistance within greater society, upon which the community can depend if local adaptive capacity is overwhelmed, and;
3) Develop local adaptive capacity to aid the rehabilitation of surrounding, affected communities as a way of building mutual, regional resilience; and
4) Enhance the speed and effectiveness of the recovery process by bringing stakeholders together to build a vision for community renewal through strategic sustainable development and resilience building.

The Structure of the Pre-DRP FSSD

The Pre-DRP FSSD is based on the Framework for Strategic Sustainable Development (FSSD), a planning tool for sustainability in complex systems (see Figure 1). The FSSD “consists of a backcasting planning process for sustainable development based on four principles (system conditions) for sustainability,” which can be used by decision makers to develop a strategic action plan (Broman, Holmberg, and Robért 2000, 3). General criteria and recommendations relevant to community sustainability and resilience form the basis of the Pre-DRP FSSD and the framework is organized into three planning categories: Systems, Success and Strategic (as in the FSSD). Actions and Tools levels are also included to guide the selection of actions and tools in accordance with the Strategic Guidelines for success, but are left open for planners to fill in according to specific planning contexts.

- Identification of the system relevant to the overall goal (Success), including subsystems and relationships. The global socio-ecological system (society within the biosphere).
- The overall goal, or outcome, to be achieved for the planning process to be successful. Sustainability means that society is in compliance with the Sustainability Principles (SPs).
- The Strategic Guidelines used to select actions that will lead to achievement of the goal (Success); Backcasting from the SPs and prioritization questions.
- Concrete actions selected in accordance with the Strategic Guidelines to reach sustainability.
- Tools that support the planning and implementation of chosen actions.

Figure 1. The Framework for Strategic Sustainable Development (FSSD)
**Systems Level**

To navigate planning in the socio-ecological system (SES), it is important to recognize that it behaves as a complex adaptive system, a non-reductive system “in which many agents, elements, and subsystems interact in densely connected networks” (Espinosa and Porter 2011, 56). In this type of system, humanity and nature co-evolve in a “dynamic fashion within the biosphere” (Folke et al. 2002, 12), and therefore, cannot be analyzed separately. To explain, human society is embedded in the biosphere and communities form subsystems within society (refer to Figure 2 for descriptions). The biosphere is the system, and for society to function, it depends on ecosystem services from the biosphere such as clean air, fresh water stocks, shoreline and erosion protection and biological diversity. All of these subsystems are integral components to Pre-DRP as it occurs within the global SES.

*Figure 2. Characteristics of the subsystems in Pre-DRP within the global socio-ecological system.*
Successful Outcomes Level

‘Success’, or the overall goal of a Pre-DR plan, is the desired outcome of an implemented plan for disaster recovery. Through actions that align with the Strategic Guidelines leading to success as outlined in the Pre-DRP FSSD, a community, region or nation can strategically move toward:

1. **Sustainability** – the capacity to endure within socio-ecological limits, as defined by **compliance with the four Sustainability Principles**. Thus, in a sustainable society, nature is not subject to systematically increasing:

   1. Concentrations of substances extracted from the earth's crust (such as fossil fuels, rare minerals, and potent metals like mercury)
   2. Concentrations of substances produced by society (including persistent and foreign compounds like CFCs)
   3. Degradation by physical means (i.e. deforestation and pollution), and;
   4. In that society, people are not subject to conditions that systemically undermine their capacity to meet their needs (subsistence, protection, affection, understanding, participation, leisure, creation, identity and freedom).

2. **Resilience** – the capacity to resist or adapt to changing system conditions (like those that contribute to disasters). Thus, in a resilient society, one or more of the following properties (the **3Rs**) can be attributed to the determinants of **adaptive capacity**:

   a. **Robustness** - “the resource strength, in combination with a low probability of resource deterioration”
   b. **Redundancy** - “the extent to which elements are substitutable in the event of disruption or degradation”
   c. **Rapidity** - “how quickly the resource can be accessed and used (i.e. mobilized)” (Norris et. al 2008, 131).

From a Pre-DRP perspective, the community subsystem is one of the most important intervention points in the system since building local resilience
can significantly reduce disaster risk. In the Pre-DRP FSSD, community resilience is primarily influenced by the community’s **adaptive capacity**, the capacity of a system to adapt to changing conditions (Folke et al. 2002). At the community scale, a number of social mechanisms generate adaptive capacity. In other words, adaptive capacity is the collective *outcome* of a combination of **determinants**, or the dynamic characteristics of a community that shape its propensity to adapt (Smit and Pilifosova 2003, Smit and Wandel 2006). In other words, they are the elements within the community that permit continued functioning with some degree of stability when it is exposed to unpredictable conditions. Resilience emerges not as an outcome, but as a *process* where properties of the system are “able to offset a new stressor, danger, or surprise” and continue “a positive trajectory of functioning” (Norris et al. 2008, 136; 131).

In community systems, it is commonly recognized that determinants of adaptive capacity are related to the tangible resources available to the community (ABARE–BRS 2010), but they can also include important intangible processes (Jones, Ludi, and Levine 2010). Thus, adaptive capacity is not exclusively defined by what a system *has* that enables it to adapt, but also what a system *does* to enable it to adapt (Jones, Ludi, and Levine 2010). As determinants are highly context-specific, broad categories, similar to community capitals may be a plausible way to convey the characteristics of a community that contribute to its adaptive capacity. In Figure 3, determinants of community adaptive capacity are represented by overlapping spheres to illustrate that characteristics of adaptive capacity may be mutually enhancing. Examples within each of these groupings are listed in Table 1 below.

![Figure 3. Overlapping groupings of determinants of community adaptive capacity.](image-url)

<table>
<thead>
<tr>
<th>Grouping</th>
<th>Examples of the determinants of adaptive capacity</th>
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| **Natural** | Management of ecosystem services (e.g. waste recycling, carbon sinks, water and air filtration and erosion control)  
Genetic and biological diversity.  
Natural hazard barriers (e.g. mangrove forests, coral reefs, swampland).  
Regenerative processes (e.g. forests recovering from fires). |
| **Social** | Networks and institutions that nurture and develop human capital in partnership with others; i.e. families, churches, businesses, unions, schools, and volunteer groups.  
Cohesion through goodwill, empathy, fellowship, and trust.  
Trust in local leadership and accountability.  
Traditional knowledge systems. |
| **Human** | Motivation of groups and individuals.  
Education and skill sets (e.g. construction expertise).  
Knowledge acquired from lessons learned from past disasters.  
The ability of decision-makers to manage information, and the processes by which they determine the credibility of information.  
Social-psychological investment in place (i.e. attachment to “home”). |
| **Physical** | Infrastructure like roads, storm drains, dams, sea walls, etc.  
Technology (e.g. machinery, communication and warning systems).  
Buildings, housing and other shelters.  
Quality and durability of materials. |
| **Economic** | Access to financial reserves, emergency funds, or insurance.  
Stability of livelihoods.  
Diversity of employment opportunities.  
Amount and diversity of financial resources.  
Equity of resource distribution. |
**Strategic Level**

The Strategic level includes guidelines to help Pre-DR planners choose strategic actions that will move their community towards the overall planning goal defined in the Success level. As a strategy, **backcasting** from a principles-based vision of success can guide strategic planning and inform the creative tension between an envisioned future and present reality. Backcasting is a method of working backward from a goal to chart the general path of steps necessary to achieve success (Holmberg and Robèrt 2000). Forecasting, i.e. projecting the future from past and current trends, is a complimentary method of plotting and double-checking the necessary steps going forward in order to reach a vision of success. It can be highly useful in Pre-DR since the knowledge necessary for pre-planning is often based on lessons learned from past disasters.

Decision makers using the Pre-DRP FSSD can also employ **Prioritization Questions** (listed below) to evaluate the effectiveness and contributions of strategic actions toward the overall goal (Success). Essentially, actions that garner a ‘no’ in response to the Prioritization Questions are given lower priority (or are ruled out) in the final strategic action plan. Establishing a way to gauge priority allows planners to adjust their plan of action as actions are brainstormed or as conditions change, while keeping their vision of success at the forefront. Guiding considerations for the prioritization of actions in Pre-DRP should include:

1. Does the action enhance the adaptive capacity of the community?
2. Does the action maneuver the community and society closer to compliance with the Sustainability Principles?
3. Does the action lead to a flexible platform for future advancements toward compliance with the Sustainability Principles?
4. Is the action likely to catalyze further progress (provide a return on investment or leverage) of other aspects of the recovery process?

In addition to these considerations, Table 2 presents guidelines that are designed to help Pre-DRP FSSD users **eliminate barriers** to success. These strategic recommendations have been influenced by a variety of literature (Sinha 2008; NDRF 2010; McEntire, Crocker and Peters 2010) and are intended to help users lay the groundwork for resilience and sustainability during post-disaster recovery.
| Local Primacy | Local governments have the primary authority and responsibility to direct recovery efforts with the support of national governments, when necessary. National governments are considered a partner and facilitator in recovery operations and should be prepared to step in should local governments be overwhelmed (NDRF 2010). Government endorsement of accountability in Pre-DR plan is recommended as well as the clear establishment of authority roles. |
| Inclusiveness and Empowerment | Pre-DR plans should target the participation and commitment of all stakeholders included in recovery, especially marginalized groups in society. The objective of inclusiveness is to provide disenfranchised citizens “the opportunities and tools to meaningfully participate and contribute to the recovery effort” (NDRF 2010). Citizen commitment and participation in local leadership roles should be encouraged as well as an emphasis on local job creation through recovery activities. |
| Multi-Sectoral Coordination | Rich networks of community-based organizations and stakeholders should be developed and the roles and responsibilities of these actors clearly defined. |
| Transparency & Accountability | Clear communication pathways should be developed to relay information through a process that is inclusive of and accessible to the general public and all stakeholders. |
| Holism | Pre-DR plans should maintain a systems perspective. This allows for improved management of tradeoffs, analysis of long-term consequences of immediate actions, and the identification of vulnerability in order to target resilience building by strengthening adaptive capacity. Embracing profound system dynamism as a feature of the system promotes creative adaptations towards resilience and sustainability rather than trying to force a return to pre-disaster normalcy (and its inherent vulnerability). Pre-DR plans should incorporate awareness mapping of available aid, funding, knowledge, skills, technical expertise of local and external recovery actors, and government roles and contingency plans. In order for a Pre-DR Plan to be adapted to a community, certain context-specific features such as hazard risks, key stakeholders, strategic relationships, available resource stocks and flows, existing vulnerabilities, and economic, social and ecological conditions need to be considered through a whole systems viewpoint. |
Mitigation
Pre-DR plans should incorporate hazard risk reduction and development challenges, and use lessons learned from prior disasters to forecast future threats and challenges.

Flexibility
Actors of the plan are provided a degree of flexibility in the design of their roles to meet evolving recovery needs. Also, according to Prioritization Question 3, chosen actions should lead to a future that allows flexibility for subsequent actions toward the overall goal of success.

Build Back Better (BBB)
Guiding approach to ensure the community is built back to be resilient to the next disaster instead of building back the pre-existing vulnerabilities. This approach may include: a program of restoration of ecosystem services, the reconstruction of built infrastructure to minimize ecosystem disturbance and the preparation of revised land use plans and building codes.

Actions Level
Actions in Pre-DRP could include mitigation projects, stakeholder engagement techniques and preparedness measures among others. The Strategic Guidelines outlined above are used to select actions that will move a particular society or community towards Success. The Pre-DRP FSSD provides guiding strategies for the selection of actions but as actions tend to be context specific, it is expected that the users of the Pre-DRP FSSD will determine the actions that fit this level of the framework.

Tools Level
This level may include tools that measure resilience or strengthen a community’s adaptive capacity, as they relate to the implementation of chosen actions. Tools selected during planning will support the Actions and Strategy levels in order to achieve Success. Again, The Pre-DRP FSSD provides guidance and overall strategies for selecting tools but does not suggest specific tools to use. Tools will depend on the knowledge and ability of the users to effectively use selected tools.