

Applying the Capability Approach to Post-disaster Recovery Policy: Rikuzentakata after the Great East Japan Earthquake and Tsunami

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Abstract This study attempts to apply Amartya Sen's capability approach (CA) to analyze the recovery of people's well-being after the Great East Japan Earthquake and Tsunami on March 11, 2011. In Rikuzentakata, a city in the Iwate Prefecture, a tsunami damaged the city area and coastal natural environments, including beaches, coastal forests, and lagoons, some of which completely disappeared. Reconstruction of residential land and infrastructure, such as seawalls, have taken several years to complete, and many residents have been forced to live in temporary housing for a long time. Because temporary housing was built on school grounds, children's opportunities for activities decreased.

The study begins with an application of CA to post-disaster community recovery, especially the regeneration of the coastal natural environment. This approach focuses on people's abilities to convert the various nature's ecosystem services into what people can do and be in their lives.

To measure child well-being after the disaster, micro data from the Child Living Conditions Survey conducted by the Rikuzentakata City Government in December 2017 was used. To analyze children's capability deprivation, not only income poverty but also children's lack of nature experience activities. These analyses show evidence that children in all types of households face a serious lack of experiences.

Keywords: Great East Japan Earthquake and Tsunami, post-disaster recovery, coastal natural ecosystem services, capability approach, children's capability deprivation

Introduction

Human beings enjoy various benefits directly and indirectly from the ecosystem. The Millennium Ecosystem Assessment (MA) was a pioneering study of the ecosystem services and an assessment of nature's contribution to humane well-being (MA, 2005). Following the MA, researchers from the fields of environmental and ecological economics have measured and evaluated the economic value of ecosystem services.

However, few reliable indicators of human well-being affected by changes in ecosystem services

exist, which is a problem and leads to research questions. How do people convert various ecosystem services into well-being? How do people assess and measure the value of ecosystem services?

When considering these issues, in this study, Amartya Sen's capability approach (CA) is used as a guide, because Sen pioneered an approach to understand the state of well-being by shifting the subject of economic analysis from goods to the way of life.

By applying the CA, this study shows the process by which people enjoy various ecosystem services and convert them into human well-being. CA will prove its worth in the case of natural disasters that have catastrophic effects on human well-being. Large-scale disasters, such as earthquakes and tsunamis, result in loss of life (human/non-human), destruction of habitats, and degradation of the ecosystem, which diminishes the human ability to enjoy ecosystem services. By analyzing the degradation and recovery of people's well-being after the Great East Japan Earthquake and Tsunami on March 11, 2011, this study demonstrates that recovery of the ability to enjoy ecosystem services impacts the recovery of human well-being.

The remainder of this article is organized as follows. In Section 1, the conceptual framework of the CA for analyzing the process of enjoying ecosystem services is discussed. In Section 2, the case of Rikuzentakata, Iwate Prefecture, where a tsunami severely damaged the city, is outlined, and the protracted post-disaster reconstruction projects are reviewed. In Section 3, child poverty and deprivation after the disaster are measured, indicating the deprivation of children's experiences in nature. And the final section presents the conclusion.

1. Applying the CA to analysis of ability to enjoy ecosystem services

1.1. Conceptual framework of CA

According to Sen, to assess the well-being that a person has achieved or could achieve, it is not sufficient to know the resources a person owns or uses. For example, if a person is disabled, then a bike will be of limited help for mobility. By analyzing goods and their subjective utility—and happiness or desire-fulfillment—we do not assess a person's well-being due to the problem of adoptive preference formation. This preference has been found in hopelessly deprived people who adjust their desires and expectations to what they see as feasible. Hence, they train themselves to take pleasure in small things (Sen, 1985).

To assess people's well-being, it is important to analyze how much "functioning" (being and doing) one gets from a good. Important functionings can vary from elementary activities, like being adequately nourished, having good health, avoiding escapable morbidity and premature mortality,

to more complex achievements, such as having adequate self-respect and actively participating in community life. “Capabilities” represents a bundle of functionings (opportunities set), a range of being and doing that people value. This range is the measurement scale of people’s well-being or well-being freedom. According to CA, “the quality of life a person enjoys is not merely a matter of what he or she achieves, but also of what options the person has had the opportunity to choose from” (Sen, 1985).

The conversion factors represent how much functioning (being and doing) one can achieve from a good and are categorized into three groups: personal, social, and environmental (Sen, 1985; Robeyns, 2005). All conversion factors influence how a person can be or is free to convert the characteristics of the resources into a functioning. CA defines the lack of conditions where people convert goods into functionings and lack of basic functionings or capabilities for people’s well-being as capability deprivation and poverty. This approach suggests a requirement for public policy to establish social conditions where people can achieve what they value.

According to Sen’s CA, basic functions or capabilities are not identified transcendentally, but they are scrutinized in public deliberation. Sen invokes the reflective devices of Adam Smith’s idea, “impartial spectator”, in *The Theory of Moral Sentiments* (Sen, 2009).¹ Public deliberation requires scrutiny from the perspective of a “impartial spectator” at a distance beyond reasoning that may be constrained by local conventions of the thought and parochial sentiments (Sen, 2009).

By transforming an analytical target from goods and services to people’s functionings, namely based on interpersonal comparisons, the CA focuses on the contents of human well-being, basic functionings or capabilities, and social conditions to achieve them.

1.2. Conversion factors of ecosystem services into people's well-being

In this section, we attempt to apply Sen's CA to analyze the process of enjoying ecosystem services. Figure 1 shows the conceptual framework of the processes that convert ecosystem services to people's doing and being (i.e., functionings) in which they have reason to value.

As shown in Figure 1.1, CA is characterized by introducing an objective informational basis called people's functionings and capabilities between nature's ecosystem services and individuals' subjective utilities.

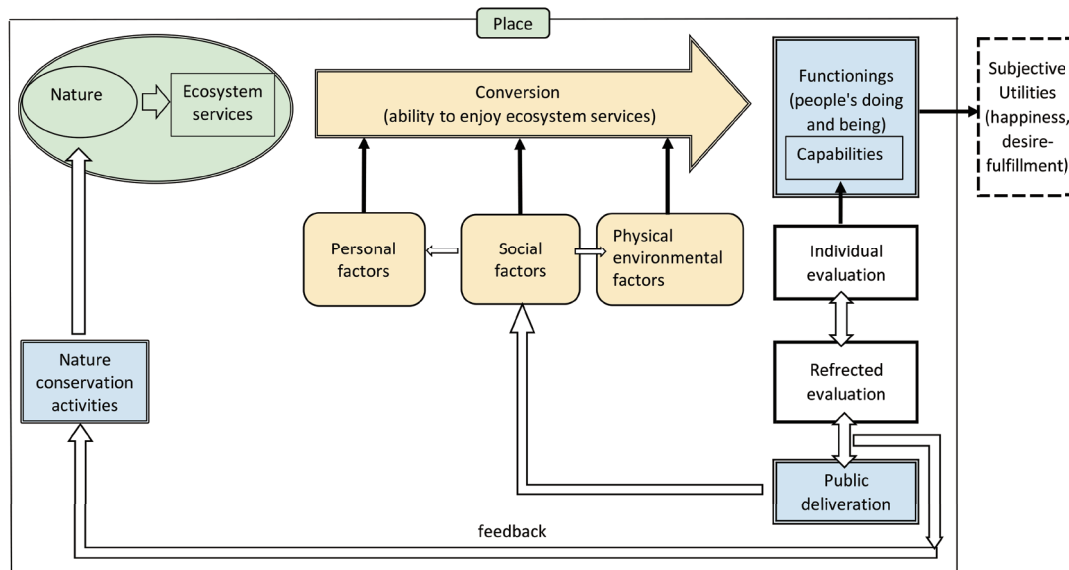


Figure 1.1 Conceptual framework: Process of enjoying ecosystem services from the CA point of view

(i) *Ecosystem services*

Ecosystem services are the direct or indirect contributions of the structure and functions of ecosystems for human well-being. Many important ecosystem services are non-marketed, a necessity and not a luxury (Dasguptha, 2001; UNU-IHDP and UNEP, 2012). The MA offered a four-way classification of ecosystem services: i) provisioning services (e.g., food, fiber, fuel, fresh water); ii) regulating services (e.g., disease regulation, protection against natural hazards such as storms, the climate system); iii) supporting services (e.g., nutrient cycling, soil production); and iv) cultural services (e.g., recreation, cultural landscapes, aesthetic, or spiritual experiences). Provisioning and cultural services contribute directly to human well-being, whereas others like soil production contribute indirectly by providing the means to grow food crops (MA, 2005).

This study focuses on cultural services including recreation, cultural landscapes, and aesthetic or spiritual experiences. For example, before the tsunami disaster on March 11, 2011, residents convert coastal ecosystem services into various functionings (beings and doings) including taking a

walk on a white sandy beach and blue pine, swimming on the shores of the bay where the waves are quiet, digging clams at the beach and tidal flats, and catching fish by hand in estuaries.

(ii) Conversion factors

A person can convert the characteristics of the ecosystem services into a functioning or may be constrained by three types of conversion factors: personal (physical characteristics in relation to age, gender, disability, proneness to illness and so on), social (education, social capital, social norms, institutions, and public policies), and physical environmental (climatic circumstance, pollution, geographical location etc.). These three types of conversion factors affect the ability to enjoy ecosystem services.

For example, a disabled person may face difficulty in enjoying specific types of ecosystem services. However, if social conditions, such as transport services for disabled persons, are adequate, he/she may enjoy the cultural services provided by a coastal ecosystem. Conversely, without adequate transportation, the ecosystem service is not feasible for the disabled person. Children with rich experiences of playing in nature may value these experiences. Conversely, children with poor experiences of nature may not value them. Additionally, persistently deprived children may not value any cultural services provided by ecosystems.

(iii) Place

Converting ecosystem services into human well-being are conducted in our daily lives where people value themselves. Local ecosystems offer people a sense of place and cultural landscape.

The inhabiting biological community differs depending on the “place,” and therefore, the types and processes of ecosystem services are influenced by the spatial area or landscape. Through interaction between nature and people in a specific place, people enjoy the ecosystem services and convert them into doing/being valued.²

(iv) Public deliberation and commitment to conserve nature

It is imperative to understand basic functionings or capabilities? According to Sen, the specific list of services and functionings was left to public discussion where social consensus is built. They are not identified as transcendental solutions but are based on critical scrutiny from an impartial (open) spectator. Public deliberations provide individual evaluations of the use and enjoyment of the ecosystem service.

According to our framework, based on these reflections, people select behaviors, such as nature conservation activities. These conservation activities are clear departures from self-interested behav-

iors. It is an action based on “commitment”. Sen emphasizes that “one areas in which the question of commitment is most important is that of public goods” (Sen, 1977/1982:94-95).³

2. Tsunami, natural and build environment, survivor’s well-being

2.1. Loss and degradation of natural coastal environment and people’s life after the Tsunami

The Great East Japan Earthquake and Tsunami on March 11, 2011 resulted in many deaths and missing people. Survivors lost family and friends and born the burden of grief and pain. Houses, schools, and workplaces were flooded and destroyed by the tsunami. Many survivors were forced to live in temporary housing for a long time and to take unstable jobs.

Great earthquakes and tsunamis hit coastal natural environments, such as rivers, beaches, coastal forests, lagoons, wetlands, and seaweed beds are referred to as ecotone and are habitats of diverse life. The coastal area of Rikuzentakata, Iwate Prefecture, had a coastal pine forest of 70, 000 trees that was planted as a tidal forest and a sand-proof forest in the Edo period. It is called Takata-matsubara and was the place of relaxation for many residents before the tsunami. However, due to the tsunami and subsequent land subsidence, the coastal forest has totally disappeared (Urabe and Nakashizuka, 2016). The degradation of natural environment has resulted in a decrease in the ability to enjoy ecosystem services, which subsequently decreases human well-being.

After the tsunami disaster, the reconstruction projects severely impacted survivor’s well-being and the coastal natural environment. Large-scale construction, including a sea wall, a flood gate, ground raising, artificial change of forest and river, and coastal ecotone, divided the ecological relationship between sea and land. In Rikuzentakata, where the city center was destroyed by the tsunami, residential land had to be built by deforestation on a mountainside and land embarkment. A large amount of soil was carried out on a huge conveyor with a total length of three kilometer and used to raise the land flooded by the tsunami. Therefore, most housing reconstruction projects lasted more than seven years, until 2018, and the inconvenience of daily life in prefabricated temporary housing continued for a long time.

Table 2.1 Types of housing reconstruction and progress rate in Rikuzentakata (2012-2018, end of March)

	Non governmental reconstruction		Government-driven projects				Total	Progress rate ^a (percentage)
	Outside the city	Individual self-help	Public housing	Collective relocation	Land readjustment	Other		
2012	90	260					350	9.7
2013	211	485				2	698	19.4
2014	278	704		14		31	1,027	28.5
2015	326	838	161	99		60	1,484	41.2
2016	358	926	312	258	30	91	1,975	54.8
2017	393	983	681	301	77	101	2,536	70.3
2018	425	1,024	703	361	144	109	2,766	76.7
2018 (D) ^b	463	1,049	692	398	210	114	2,926	81.1

^a proportion to total 3, 607 households receiving the payment of support grants for Reconstructing Livelihoods of Disaster Victims.

^b December 2018.

Source: Rikuzentakata City (2019)

In this city, 3, 805 houses were completely collapsed, and total households receiving the payment of support grants for Reconstructing Livelihoods of Disaster Victims were 3, 607 households. Table 2.1 shows the progress rate of housing reconstruction. The progress rate in March 2014, after three years from the tsunami, was only 28.5 %, and 54.8 % in March 2016 yet. A large part of the reconstructed housings were “individual self-help” and “reconstructed outside the city.” In December 2018, half of the reconstructed housings did not have government-driven reconstruction projects.⁴

2.2. Loss and grief embedded in the place

As mentioned in 1.2, in daily life, people enjoy ecosystem services in a specific “place”. However, the “place” in the disaster area has complex and serious problems. In 2010, before the tsunami, the total population in Rikuzentakata was 23, 300.⁵ Due to the tsunami, 1, 557 people had lost their lives, and 202 people are still missing.⁶ For the survivors, the place for which they felt a strong attachment had changed drastically, especially as it had become the place where they suddenly lost a loved one to the tsunami. One survivor said, “After the tsunami, for a while, the surrounding scenery looked monotonous.” Due to the drastic environmental change caused by the tsunami and the subsequent reconstruction projects, many survivors were confused by the overwhelming gap between memory and reality. In the tsunami-hit area, at the strong request of bereaved families,

searching for missing persons by police officers and volunteers continued. Loss and grief may interfere with the recovery of people's ability to enjoy neighborhood landscape and ecosystem services in the place.

However, after the tsunami and during the reconstruction process, residents in disaster-stricken areas held voluntary meetings to hear from older residents about memories of old landscapes as part of community revitalization. Such steady efforts are extremely important for the restoration and regeneration of the human ability to enjoy neighborhood landscape and ecosystem services. In Rikuzentakata, on Jun 2019, eight years after the tsunami, when large-scale construction settled down, nature observation meetings were hosted by residents in the Kawahara River. This river pouring into Hirota Bay originates from Mt. Hikami and runs through the north and south of the central city area, is an important river that forms the skeleton of the local ecosystem. Many residents of this area have experience in damming the Kawahara River, catching salmon, and watching fireflies upstream, and there is hope to pass on these experiences to their children.⁷

3. Children's well-being after the tsunami

In Rikuzentakata, because reconstruction of residential land and infrastructure was carried out on a huge scale and took several years to complete, the recovery of children's daily lives has been a low priority.

Because temporary housing was built on school grounds, temporary school grounds were installed far from school building, and children's play opportunities decreased. Large trucks and construction vehicles frequently passed through the roads in the city, which meant that many children were going to and from school by school-bus or their parent's private cars, rather than walking. Children's opportunities for play outside and after-school clubs with friends in their neighborhoods were severely constrained.

To measure children's well-being, poverty and deprivation after the disaster, the Rikuzentakata City government conducted, earliest in the affected municipalities, the Child Living Conditions Survey in December 2017. After the Great East Japan Earthquake and Tsunami, an act on Promotion of Policy on Poverty among Children was enacted in 2013, since then, many municipalities have begun conducting surveys on child poverty.

The Rikuzentakata survey asked respondents (parents) damage caused by the disaster, disposable income, household economic stress (non-payment of public utility bills and housing rent, experience of not being able to buy food or clothing, etc.), and children's lack of possession and experiences (family meals, child's own desk, child's own room, and nature experience activities such as camping etc.) (Rikuzentakata City, 2018).⁸

A questionnaire was distributed to parents in 1, 923 households, 488 households with junior high students, 748 households with elementary students, and 488 households with preschool children. The breakdown of the responding households is as follows: 415 (88.9%) households with junior high school students, 639 (97.1%) households with elementary students, and 477 (80.9%) households with preschool children (Rikuzentakata City, 2018).

Table 3.1 Impact of the disaster on households with children (proportion of children)

Types of school	Yes		No		Total	
	N	Percentage	N	Percentage	N	Percentage
Junior highschool students						
house damaged	200	46.5%	231	53.6%	431	100.0%
family affected	60	14.0%	370	86.0%	430	100.0%
work lost	67	15.6%	363	84.4%	430	100.0%
Elementary students						
house damaged	268	42.9%	357	57.1%	625	100.0%
family affected	77	12.6%	533	87.4%	610	100.0%
work lost	83	13.6%	526	86.4%	609	100.0%

Notes: “unknown” and no answer were excluded from the total.

Source: Our elaboration on Rikuzentakata City (2018).

In the parent survey, looking at the damage situation of households with children, Table 3.1 shows that 200 (46.5%) junior high students, 268 (42.9%) elementary students faced house damaged by the disaster. As a result, significant percentage of children were forced to wait for housing reconstruction. And households with children had large mortgages which put pressure on their livelihoods.

For studying the income poverty situation, households with equivalized disposable income less than the national poverty threshold (1.220 million yen/year according to the Comprehensive Survey of Living Conditions 2015 by Ministry of Health, Labour and Welfare) are considered households with “high difficulty” (income poverty).

Table 3.2 indicates the breakdown of the children’s income poverty rate, 16.4% of junior high school students, 19.7% of elementary students are below the national poverty threshold (Rikuzentakata City, 2018). Looking at each household type, for both elementary and junior high school students the poverty rate of single-mother families is relatively high.

Table 3.2 Children income poverty rates by household type

		Non-poor	Poor	Total
Junior highschool students				
Two-parent families	N	263	37	300
	%	87.7%	12.3%	100.0%
Single-mother families	N	30	22	52
	%	57.7%	42.3%	100.0%
Others	N	23	3	26
	%	88.5%	11.5%	100.0%
Total	N	316	62	378
	%	83.6%	16.4%	100.0%
Elementary students				
Two-parent families	N	351	58	409
	%	85.8%	14.2%	100.0%
Single-mother families	N	41	39	80
	%	51.3%	48.8%	100.0%
Others	N	19	4	23
	%	82.6%	17.4%	100.0%
Total	N	411	101	512
	%	80.3%	19.7%	100.0%

Note: “unknown” and no answer were excluded from the total.

Source: Author’s own analysis of Rikuzentakata City (2018).

Table 3.3 indicates proportion of children who are given/not given nature experience activities, such as camping, and the survey results show that 244 students (61.5%) of the 397 junior high school students indicated that they were not given nature experience activities. 324 (57.1%) of the 607 elementary students mentioned that they were not given. By household attributes, the lack of nature experience activities for children occurs not only in “single-mother families” but also in “two-parent families.” This suggests that the enormous damage caused by the tsunami and the large-scale and long-term reconstruction work have had a negative impact on children’s well-being (Date, 2019).

Table 3.3 Proportion of children who are given/not given nature experience activities by household type

		Given	Not given	Total
Junior highschool students				
Two-parent families	N	125	191	316
	%	39.6%	60.4%	100.0%
Single-mother families	N	12	42	54
	%	22.2%	77.8%	100.0%
Others	N	16	11	27
	%	59.3%	40.7%	100.0%
Total	N	153	244	397
	%	38.5%	61.5%	100.0%
Elementary students				
Two-parent families	N	234	260	494
	%	47.4%	52.6%	100.0%
Single-mother families	N	36	52	88
	%	40.9%	59.1%	100.0%
Others	N	13	12	25
	%	52.0%	48.0%	100.0%
Total	N	283	324	607
	%	46.6%	53.4%	100.0%

Note: “unknown” and no answer were excluded from the total.

Source: Author’s own analysis of Rikuzentakata City (2018).

Residents along with the city government should implement public discussions about the results of the survey to reduce children’s poverty. Based on the United Nations Convention on the Rights of the Child, children would be required to take part in the public discussion (Biggeri, 2007). For the moment, it is recommended that residents discuss the contents of the survey and the deprivation of necessities, including children’s experiences in nature, playgrounds, while considering adoptive preference formation (Nusbaum, 2000).

In addition, for residents to overcome local narrowness, it will be necessary to introduce the perspective of external “fair and impartial spectators”, such as policy makers, NGOs, and researchers in other regions where similar surveys have been conducted.

4. Conclusion

According to CA, the post-disaster recovery process is a fundamental process that residents undertake as part of their agency empowerment to enjoy various real freedoms (Sen, 2009). In the disaster area, recovery of the ability to enjoy nature's various ecosystem services will be key to the recovery of residents' well-being, the recovery of natural environment and ecosystem services, and the interaction between nature and humans in daily life.

Our analysis offers some implications. First, in Rikuzentakata, the reconstruction of children's daily lives was not a high priority, because the restoration and reconstruction of infrastructure and residential land was large-scale and prolonged due to the severe damage caused by the tsunami.

Second, evidence of the deprivation of children's experiences in nature included deprivation of the "necessities for daily life." Children's experiences in nature are one way of enjoying ecosystem services and is important for developing their ability for the future. For the recovery and regeneration of children's ability to enjoy ecosystem services, improvement of social conditions through public policy will be essential.

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Notes

1. "We can never survey our own sentiments and motives, we can never form any judgement concerning them; unless we remove ourselves, as it were, from our own natural station, and endeavour to view them as at a certain distance from us. But we can do this in no other way than by endeavouring to view them from the eyes of other people, or as other people are likely to view them. ... We endeavour to examine our own conduct as we imagine any other fair and impartial spectator would examine it," (Smith, 1790, III .1.2, in the 1976 reprint, p.110).
2. Interestingly, Bryan Norton proposed the theory of environmental values by an endorsement of the importance sense of place of values that emerge from experience of one's home place. (Norton, 2003).
3. Sen argued "commitment" is "concerned with breaking the tight link between individual welfare and the choice of action, whereas mainstream economics equate individual welfare with choice of action." (Sen, 1982).
4. For detailed analysis of individual self-help reconstruction, see Kondo and Karatani (2016), Kondo (2017).
5. Statistics Bureau, Ministry of International Affairs and Communication, 2010 Populations Census.
6. Fire and Disaster Management Agency (2020).

7. Considering the recovery and regeneration of children's ability to enjoy ecosystem services in Rikuzentakata, the case of three-generation family participatory research on biodiversity and children's play near water conducted by Biwa Lake Museum, Shiga Prefecture, in 1994, may be beneficial. According to Yuma et al. (1997), children's play near water, such as catching fish, establishes the relationship between the natural environment (i.e., diverse fish, shellfish etc.) and humans. By studying changes in children's play near water, changes in the physical and spiritual "distance" between the natural environment and humans can be clarified concretely. Hence, according to our framework (see Figure 1.1), this "distance" is between ecosystem services and people's functionings in a specific landscape. These studies will be relevant for children living in areas devastated by tsunamis.
8. Recent studies on child poverty follow the EU method and consider the lack of experiences and possessions of children as "relative deprivation" and "relative poverty." Attempts have begun to grasp poverty in a multifaceted and comprehensive manner (Abe, 2019). A typical example is the Report of the Tokyo Prefecture Child Living Conditions Survey, which was commissioned by the Research Center for Child and Adolescent Poverty of the Tokyo Metropolitan University in 2016. The Tokyo Indicator of Hardship for Children is constructed in three dimensions: income poverty, household economic stress, and children's lack of possession and experiences.

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