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Policy Forum Article

The Future of Ecosystem Services in Asia and the Pacific

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Abstract

We estimated the current value of ecosystem services for terrestrial ecosystems in 47 countries in the Asia and the Pacific region. Currently, these provide $US14 trillion/yr. in benefits, most of which are non-marketed and do not show up in GDP. We also estimated the changes in terrestrial ecosystem services value for scenarios to the year 2050, built around the four Great Transition Initiative archetypes: (1) Market Forces (MF); (2) Fortress World (FW); (3) Policy Reform (PR); and (4) Great Transition (GT). Results show that under the MF and FW scenarios the ecosystem services value in the region continues to decline from $14 trillion/yr in 2011 to $11 and $9 trillion/yr in 2050, respectively. In the PR scenario, the value is maintained around $14 Trillion/yr in 2050 and in the GT scenario it is significantly restored to $17 Trillion/yr. We also show more detailed maps and results for 8 selected countries in the region (Bhutan, China, India, Philippines, Thailand, Cambodia, Laos, Vietnam) and compare our results with a previous national study of Bhutan. Our results indicate that adopting a set of policies like those assumed in the GT scenario would greatly enhance human wellbeing and sustainability in the region.

Key words: Ecosystem Services, Scenario Planning, Sustainable Development, Well-Being, Ecosystem service mapping

1. Introduction

Many of the countries in the Asia and Pacific region are on a path of development similar to the one taken by Europe and the United States over the past few centuries. This form of development focuses on growth of Gross Domestic Product (GDP) (Costanza et al. 2014) with little regard to damages to natural and social capital. This kind of development replaces natural capital with built capital (Kubiszewski et al. 2013) which in turn damages ecosystem services in the process. This pattern of development also increases income and wealth inequality while damaging social capital in the process.

Ecosystem services are a major contributor to sustainable human well-being (Costanza et al. 1997; Millennium Ecosystem Assessment (MEA) 2005). GDP growth focused development has already had a significant negative impact on the global value of ecosystem services. Between 1997 and 2011 the global value of ecosystem services decreased by an estimated USD 20 trillion/yr due to land use change (Costanza et al. 2014). This is a loss comparable to about 1/3 of the global GDP in 2011.

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This paper develops and evaluates ecosystem services scenarios for the Asia and the Pacific region out to the year 2050. It shows the consequences of various policy decisions on land-use and the value of ecosystem services.

1.1. Scenarios

Scenario planning is a structured process of assessing alternative futures (Kahane 2004; Bohensky et al. 2011; Costanza et al. 2015). The goal of scenario planning is to present potential futures based on policy decisions around influential and uncertain drivers (O'Brien 2000). Unlike forecasting, projections, and predictions, scenarios explore *plausible* rather than *probable* futures (Peterson et al. 2003).

The four scenarios developed for this study are a synthesis of prior scenario studies, but are based around the four 'Great Transition Initiative' (GTI) archetypes (Hunt et al. 2012) created by an international network of scholars, using models and regional analyses (Raskin et al. 2002; McGrail 2011). The GTI also developed land and water use projections for each scenario, which we incorporated. The GTI scenarios are described in more detail later, but in summary are:

1. **Market Forces (MF):** an economic and population growth archetype based on neoliberal free market assumptions;
2. **Fortress World (FW):** an archetype in which nations and the world become more fragmented, inequitable, and head towards temporary or permanent social collapse;
3. **Policy Reform (PR):** a continuing economic growth archetype, but with discipline/restraint/regulation based on assumptions about the need for government intervention and effective policy; and,
4. **Great Transition (GT):** a transformation archetype based on assumptions about limits to conventional GDP growth and more focus on environmental and social well-being and sustainability.

The ecosystem services in these four scenarios were estimated for all countries globally (ELD Initiative 2015). In this paper, we focus on the Asia and Pacific region.

2. Methods

3. Global and National Land use Change Scenarios

Detailed Great Transition Initiative (GTI) scenarios exist for both the global system and several regions.[1] Brief narrative descriptions of each scenario, extracted directly from the GTI website, are reproduced here:

Market Forces The *Market Forces* scenario is a story of a market-driven world in the 21st century in which demographic, economic, environmental, and technological trends unfold without major surprises. Continuity, globalization and convergence are key characteristics of world development – institutions gradually adjust without major ruptures, international economic integration proceeds apace and the socioeconomic patterns of poor regions converge slowly toward the development model of the rich regions. Despite economic growth, extreme income disparity between rich and poor countries, and between the rich and poor within countries, remains a critical social trend. Environmental transformation and degradation are a progressively more significant factor in global affairs.

Policy Reform The *Policy Reform* scenario envisions the emergence of strong political will for taking harmonized and rapid action to ensure a successful transition to a more equitable and environmentally resilient future. Rather than a projection into the future, the *Policy Reform* scenario is a normative scenario constructed as a backcast *from* the future. It is designed to achieve a set of future sustainability goals. The analytical task is to identify plausible development pathways for reaching that end-point. Thus, the *Policy Reform* scenario explores the requirements for simultaneously achieving social and environmental

1. www.greattransition.org/explore/scenarios

sustainability goals under high economic growth conditions similar to those of *Market Forces*.

Fortress World The *Fortress World* scenario is a variant of a broader class of *Barbarization* scenarios, in the hierarchy of the Global Scenario Group.(Gallopín et al. 1997) *Barbarization* scenarios envision the grim possibility that the social, economic and moral underpinnings of civilization deteriorate, as emerging problems overwhelm the coping capacity of both markets and policy reforms. The *Fortress World* variant of the Barbarization story features an authoritarian response to the threat of breakdown. Ensconced in protected enclaves, elites safeguard their privilege by controlling an impoverished majority and managing critical natural resources, while outside the fortress there is repression, environmental destruction and misery

Great Transition The *Great Transition* scenario explores visionary solutions to the sustainability challenge, including new socioeconomic arrangements and fundamental changes in values. This scenario depicts a transition to a society that preserves natural systems, provides high levels of welfare through material sufficiency and equitable distribution, and enjoys a strong sense of local solidarity.

Each of these scenarios has implications for land use and management. The interactive web tool, Futures in Motion, on the GTI website was used to derive estimates of land use change (urban, cropland, forest, grassland, desert), population, GDP, and other variables such as inequality for these four future scenarios to the year 2050.[2] The GTI scenarios did not, however, include changes in wetlands. These were estimated based on past trends in wetland loss seen between 1997 and 2011 for the MF and FW scenarios, (Costanza et al. 1997; Millennium Ecosystem Assessment (MEA) 2005; Costanza et al. 2014) a policy of 'no net loss' for the PR scenario, and an aspirational wetland restoration policy for the GT scenario based on achieving wetland areas similar to those in 2000 (Mitsch & Day 2006; Gascoigne et al. 2011; Costanza et al. 2014). These changes are described in more detail later in the section on results.

3.1. Unit Value Change Scenarios

Changes in value of ecosystem services in these scenarios were estimated to be due to two factors: 1) change in area covered by each ecosystem type; and 2) change in the "unit value" – the aggregate value of all the marketed and non-marketed ecosystem services per ha per year of each ecosystem type due to degradation or restoration. The unit values change depending on management policies of the land and water. These effects were separated out by evaluating the scenarios in two ways: a) using the 2011 unit values estimated by Costanza et al. (2014) and only changing land use; and b) changing both unit values and land use. Like all estimates at this scale, this is a simplification; however, for the purposes of this exercise it was thought to be sufficient. Obviously, much more elaborate and sophisticated modelling and analysis can be done (Turner et al. 2016), but this is left for future studies.

The unit value changes were based on policy and management assumptions likely to occur in each scenario. For example, in the Policy Reform (PR) scenario, it was assumed that a slight improvement in policies around the environment and ecosystem services would allow maintenance of the 2011 unit values until 2050, while in Fortress World (FW), unit values would decrease by 20 per cent on average. These per cent changes were based roughly on the estimates included in the Bateman et al. (2013) study of six future scenarios for the UK. However, they are not intended to be empirically derived, but rather are plausible estimates of the magnitude of change that could occur under each hypothetical scenario. In general, the following was assumed for each of the four scenarios:

1. **Market Forces-Free Enterprise:** decrease in consideration of the environmental and non-market factors resulting in an average *10 per cent reduction in unit values* from

2. www.tellus.org/results/results_World.html

their 2011 levels. In this scenario, climate change has not been dealt with.
2. **Fortress World-Strong Individualism**: *significant* decrease in consideration of environmental and non-market factors resulting in an average *20 per cent reduction in unit values* from their 2011 levels. In this scenario, climate change has accelerated.
3. **Policy Reform-Coordinated Action**: slight improvement from 2011 policies and management leading to *no significant change in unit values* from their 2011 estimates. In this scenario, climate change has been moderated.
4. **Great Transition-Community Well-Being**: *significant* increase in consideration of environmental and non-market factors resulting in an average *20 per cent increase in unit values* from their 2011 levels. In this scenario, climate change has been addressed.

3.2. Mapping

The spatial data layers for the four scenarios were created via a loose coupling with the scenario projection modelling. The modelling of each scenario generated a change in land-cover for the following types: Urban, Wetland, Cropland, Forest, Grassland, and Desert. A modified version of the GlobCov data product (Costanza et al. 2014) was used as the original base data. For each scenario, the land-cover base grew or shrank based on the percentage changes of that land-cover scenario projection. All growth and loss were adjacent to the existing original extent of that land-cover. Precedence for these land-cover changes occurred in the following order: Urban, Wetland, Cropland, Forest, Rangeland/Grassland, and Desert. This precedence worked in such a way that all previous land-cover transitions are excluded from subsequent conversion (e.g. cropland can not replace urban or wetlands). The results of these models can be presented as tables and as maps for any country or region in the world, and this paper presents examples of Bhutan, China, India, Myanmar, Philippines, and the Southeast Asia region.

4. Results and Discussion

4.1. Values in 2011

Table 1 shows the total ecosystem service values in 2011 and in the four scenarios for countries in East/South Asia and in Oceania. Not surprisingly, China has the largest ecosystem services value in 2011, at USD $3.6 trillion/year closely followed by Australia with USD $3.4 trillion/year. India and Indonesia follow closely with total ecosystem services values in 2011 of USD $1.8 trillion/year and USD $1.7 trillion/year, respectively. These ES values are similar despite India having a greater total land area (3.2 million km^2) than Indonesia, which has a land area of 1.9 million km^2. This shows that India's land has been converted to systems with lower ecosystem services unit values as compared to that of Indonesia.

In 2011, the East/South Asia and Oceania made up 22% of the world terrestrial area, 36% of Gross World Product (GWP), and 19% of the world's ecosystem services value (Table 1). The majority of this comes from Asia, which makes up 16% of the world's land area, 35% of the GWP, and 13% of its ecosystem services value. China alone is 45% of Asia's land area (7% of the world's), 43% of Asia's GDP (15% of the world's), and 36% of Asia's ES value (5% of the world's). China's ES value is not that much lower than the whole of Oceania, which has an ES value of USD $3.95 trillion/year or 5.5% of the world's total ES value. However, Oceania only makes up 1.2% percent of the world GWP. This shows that with similar land areas, China and Oceania have similar ecosystem services values, with very different GDPs.

4.2. Future Values of Ecosystem Services

Table 1 shows that the largest overall decline in ecosystem services in these regions would occur under the Fortress World (FW) scenario with a 34% decrease. The Market Forces

Table 1 The Terrestrial Values for the Ecosystem Services in 47 Countries in Asia and Oceania for the 2011 Base and Each of the Four Future Scenarios, Including the Percent Change for all Four Scenarios

Country	*Area (km2)*	*GDP, PPP (2011 Million$)*	*ESV_2011 (Million$/yr)*	*S1_MF (Million$/yr)*	*MF % change from 2011*	*S2_FW (Million$/yr)*	*FW % change from 2011*	*S3_PR (Million$/yr)*	*PR % change from 2011*	*S4_GT (Million$/yr)*	*GT % change from 2011*
East & Southeast Asia											
Brunei Darussalam	5,782	29,265	7,381	4,808	-35%	3,017	-59%	7,524	2%	9,428	28%
China	9,424,687	13,810,256	3,586,924	2,596,138	-28%	2,314,370	-35%	3,494,582	-3%	4,524,726	26%
Indonesia	1,890,911	2,171,519	1,659,467	1,208,778	-27%	925,974	-44%	1,667,742	0%	2,033,665	23%
Japan	371,865	4,386,152	157,854	148,933	-6%	133,791	-15%	161,882	3%	190,609	21%
Korea (North), Dem. Rep.	122,357	12,380	45,608	37,480	-18%	33,415	-27%	46,661	2%	54,972	21%
Korea (South), Rep.	97,442	1,559,447	37,009	35,010	-5%	31,406	-15%	38,021	3%	44,604	21%
Malaysia	330,652	624,786	233,647	177,776	-24%	148,228	-37%	234,467	0%	283,869	21%
Mongolia	1,562,289	24,526	366,685	208,211	-43%	178,675	-51%	347,763	-5%	490,316	34%
Myanmar	670,344	51,920	369,447	305,517	-17%	261,775	-29%	370,543	0%	443,431	20%
Philippines	294,228	543,771	193,465	170,597	-12%	151,681	-22%	193,483	0%	230,564	19%
Singapore	556	388,513	387.9	318	-18%	284	-27%	371	-4%	445	15%
Timor-Leste	15,155	2,202	8,775	7,635	-13%	6,812	-22%	8,800	0%	10,577	21%
Total East & Southeas Asia	**[t] 14,786,268**	**23,604,738**	**6,666,651**	**4,901,199**	**-26%**	**4,189,428**	**-37%**	**6,571,837**	**-1%**	**8,317,207**	**25%**
Percent of World	11.0%	25.7%	9.3%	9.9%		10.8%		9.1%		9.3%	
Southeast Asia											
Cambodia	182,862	38,652	103,840	85,157	-18%	75,304	-27%	108,002	4%	137,088	32%
Lao PDR	231,109	26,954	110,946	97,536	-12%	87,551	-21%	110,757	0%	132,312	19%
Thailand	515,264	913,511	280,333	247,848	-12%	221,426	-21%	282,604	1%	337,187	20%
Viet Nam	326,083	414,339	166,444	148,593	-11%	132,778	-20%	168,039	1%	199,722	20%
Total Southeast Asia	**1,255,318**	**1,393,456**	**661,564**	**579,134**	**-12%**	**517,059**	**-22%**	**669,402**	**1%**	**806,309**	**22%**
Percent of World	0.9%	1.5%	0.9%	1.2%		1.3%		0.9%		0.9%	
South Asia											
Afghanistan	643,585	49,338	198,662	56,919	-71%	45,434	-77%	178,554	-10%	271,418	37%
Bangladesh	138,492	395,684	145,974	107,655	-26%	69,847	-52%	146,427	0%	175,643	20%
Bhutan	39,997	5,040	14,862	13,255	-11%	11,766	-21%	14,936	0%	17,804	20%
India	3,166,851	5,845,362	1,825,052	1,562,620	-14%	1,357,683	-26%	1,833,906	0%	2,203,965	21%
Maldives	33	4,195	112.6	101	-10%	90	-20%	113	0%	135	20%
Nepal	147,699	55,504	62,749	54,994	-12%	48,631	-22%	63,655	1%	75,404	20%
Pakistan	879,471	750,693	294,519	157,302	-47%	137,519	-53%	264,412	-10%	413,554	40%
Sri Lanka	66,483	186,763	35,311	31,746	-10%	28,634	-19%	35,645	1%	42,457	20%

(*Continues*)

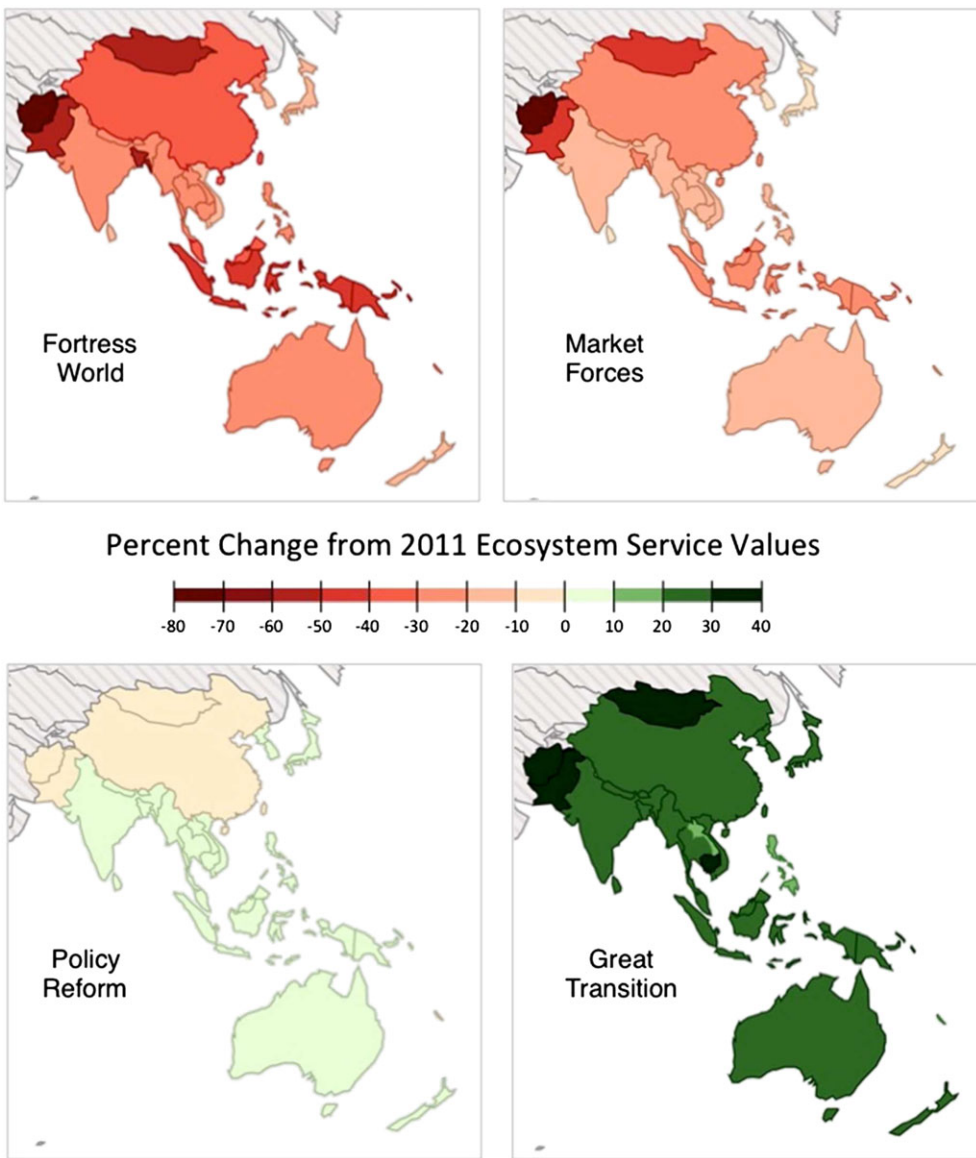
Table 1 (Continued)

Country	Area (km2)	GDP, PPP (2011 Million$)	ESV_2011 (Million$/yr)	S1_MF (Million$/yr)	MF % change from 2011	S2_FW (Million$/yr)	FW % change from 2011	S3_PR (Million$/yr)	PR % change from 2011	S4_GT (Million$/yr)	GT % change from 2011
Total South Asia	**5,082,611**	**7,292,579**	**2,577,242**	**1,984,593**	**-23%**	**1,699,603**	**-34%**	**2,537,648**	**-2%**	**3,200,380**	**24%**
Percent of World	3.8%	8.0%	3.6%	4.0%		4.4%		3.5%		3.6%	
Total Asia	**21,124,197**	**32,290,773**	**9,905,456**	**7,464,926**	**-25%**	**6,406,090**	**-35%**	**9,778,887**	**-1%**	**12,323,896**	**24%**
Percent of World	15.7%	35.2%	13.8%	15.1%		16.5%		13.6%		13.7%	
Oceania											
American Samoa	168	648	388	319	-18%	257	-34%	355	-9%	425	10%
Australia	7,718,963	932,989	3,372,020	2,729,738	-19%	2,390,895	-29%	3,359,966	0%	4,089,054	21%
Fiji	18,172	6,493	13,614	11,868	-13%	10,578	-22%	13,505	-1%	16,090	18%
French Polynesia	2,087	7.2	2,269	2,011	-11%	1,760	-22%	2,235	-2%	2,681	18%
Guam	583	4,555	497	391	-21%	350	-30%	501	1%	599	20%
Kiribati	420	174	720	648	-10%	576	-20%	720	0%	864	20%
Nauru	27	72	82	74	-10%	66	-20%	83	0%	99	20%
New Caledonia	18,928	9,900	14,656	12,436	-15%	10,981	-25%	14,399	-2%	17,492	19%
New Zealand	268,898	141,529	120,284	113,219	-6%	101,610	-16%	122,856	2%	144,828	20%
Cook Islands	150	286	282	254	-10%	225	-20%	282	0%	338	20%
Niue	252	23	318	286	-10%	254	-20%	318	0%	381	20%
Tokelau	7	1.5	0.462	0.416	-10%	0.370	-20%	0.462	0%	0.554	20%
Marshall Islands	37	184	219	197	-10%	148	-33%	219	0%	263	20%
Micronesia, Fed. Sts.	521	353	2,059	1,760	-15%	1,426	-31%	1,990	-3%	2,388	16%
Palau	385	269	468	360	-23%	322	-31%	436	-7%	521	11%
Papua New Guinea	465,595	16,418	383,293	281,905	-26%	217,283	-43%	385,237	1%	473,329	23%
Pitcairn	46	0.20	8.5	7.653	-10%	6.8	-20%	8.503	0%	10.202	20%
Samoa	2,951	1,063	3,186	2,798	-12%	2,501	-22%	3,207	1%	3,845	21%
Solomon Islands	27,165	1,063	20,482	17,821	-13%	15,852	-23%	20,191	-1%	24,009	17%
Tonga	470	525	653	549	-16%	490	-25%	653	0%	784	20%
Tuvalu	31	34	39	35	-10%	31	-20%	39	0%	47	20%
Vanuatu	12,364	705	9,727	8,231	-15%	7,321	-25%	9,590	-1%	11,484	18%
Wallis and Futuna	161	149	684	585	-14%	493	-28%	684	0%	821	20%
Total Oceania	**8,538,381**	**1,117,442**	**3,945,949**	**3,185,494**	**-19%**	**2,763,426**	**-30%**	**3,937,475**	**0%**	**4,790,352**	**21%**
Percent of World	6.3%	1.2%	5.5%	6.5%		**7.1%**		**5.5%**		**5.3%**	
Total South, East, & Southeast Asia and Oceania	**29,662,578**	**33,408,215**	**13,851,406**	**10,650,420**	**-23%**	**9,169,516**	**-34%**	**13,716,362**	**-1%**	**17,114,248**	**24%**
Percent of World	**22.0%**	**36.4%**	**19.3%**	**21.6%**		**23.6%**		**19.0%**		**19.1%**	
World	134,809,903	91,679,969	71,666,806	49,311,267	-31%	38,846,146	-46%	72,034,900	1%	89,823,433	25%

(MF) scenario also experiences a large decline in ES values in the regions with a 23% decline. Policy Reform (PR) only experiences a slight decline of 1% while the Great Transition (GT) scenario sees a gain of 24% in total ecosystem services values. Oceania is the least impacted in all four of the scenarios. In FW and MF it has the lowest decline in total ES values of all the regions with a 30% and 19% decrease, respectfully. Oceania experiences almost 0% change under the PR scenario but it also has the lowest gain under the GT scenario.

At the country level, Afghanistan showed the greatest losses in the ecosystem services values in both the FW and MF scenarios of 77% and 71% loss, respectively (Figure 1). In the PR scenario, but Afghanistan and Pakistan show considerable losses in ES values with

Figure 1 Map of the Asia and Oceania region showing the scale of percent change from the 2011 base map in ecosystem services value for each country in each of the four scenarios



10% loss. However, these two countries also showed the greatest gains under the GT scenarios with a gain of 40% in Pakistan and 37% in Afghanistan. We see the greatest changes in these countries under all the future scenarios because they are the most arid countries in this study. An arid country will experience more desertification under a bad conditions then a country that starts with a lot of water and robust ecosystems. This is also true if future conditions are good, more impact will be seen in places that have had little ecosystem services in the past since any changes will increase those services quickly. This is in comparison to an area that already had a high level of services, adding additional services in certain ecosystems will require more input. On the other hand, there is no country or countries that stand out as being least affected in all four scenarios. New Zealand, Japan, and South Korea have the smallest loss of ecosystem services value in the MF and FW scenarios, in the range of 5-6%. American Samoa and Palau have the smallest increase in the GT scenario, and there are about 20 countries that experience no change of ecosystem services value in the PR scenario.

We also pulled out eight countries in the region (Bhutan, China, India, Philippines, Thailand, Cambodia, Laos, Vietnam) for more detailed description of the results. Figure 2a-e shows land cover for each biome for the 2011 base map and the four scenarios to 2050,

Figure 2 (a-e): Maps for four countries (Bhutan, China, India, Philippines) and the Southeast Asia region (Thailand, Cambodia, Laos, Vietnam) showing the biome land use changes for four scenarios compared to 2011 ecosystem services values. First Column: **Maps of the land cover of each biome for the base map and the four scenarios.** Second Column: **Maps of the pixels changed between the base map of 2011 and each of the four scenarios. In the MF and FW maps, there are multiple symmetric circular desert areas. These occur because a single desert pixel in the original base map grew symmetrically outwards from all edges of desert.** Third Column: **Maps of the change in the value of ecosystem services between the base map of 2011 and each of the four scenarios.**

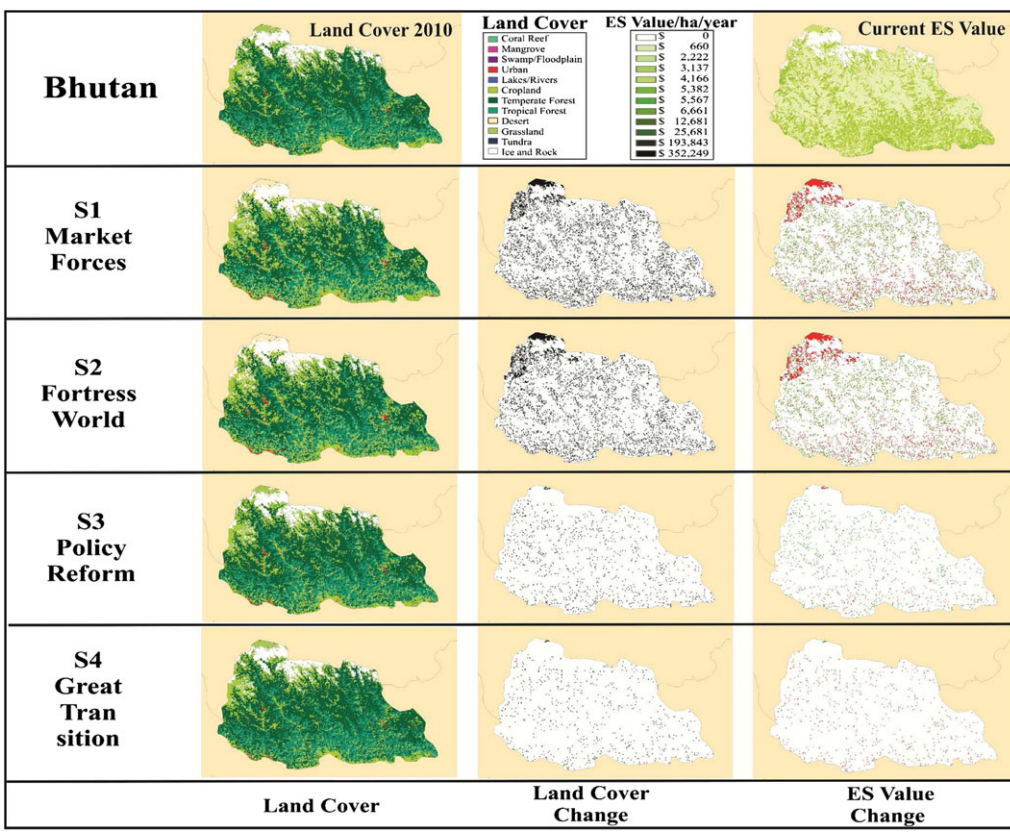
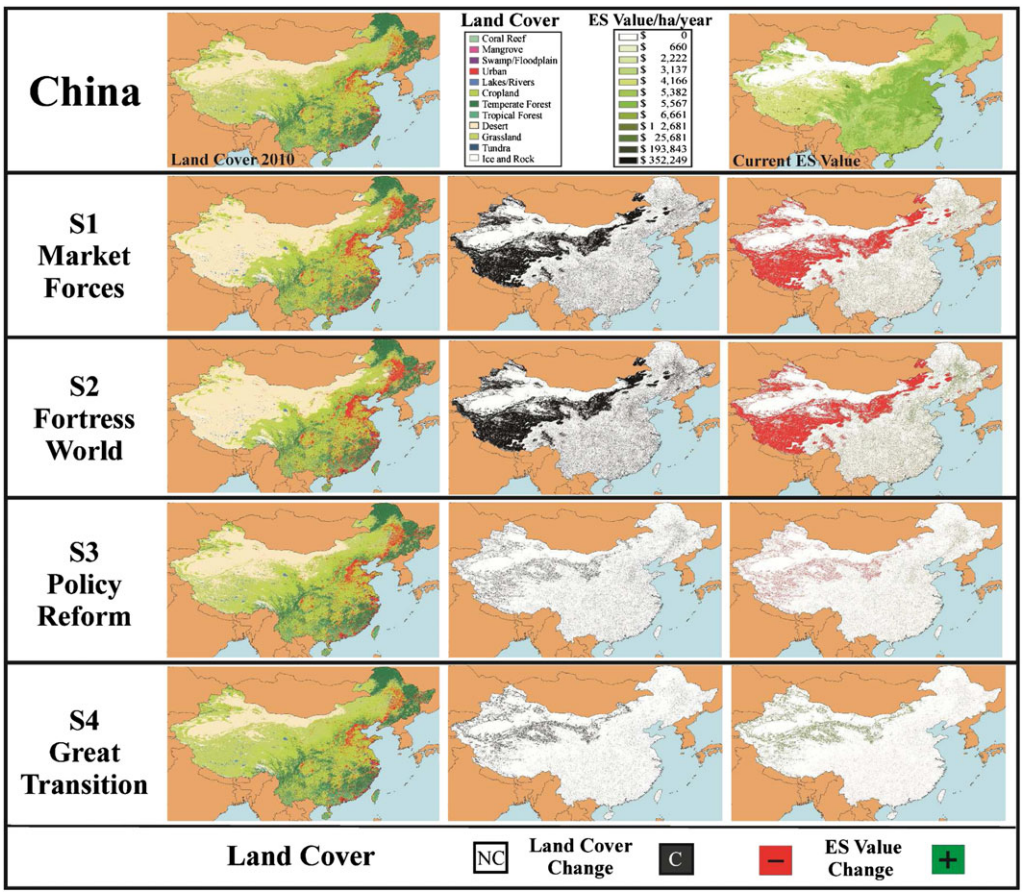


Figure 2 (Continued)



changes in the land cover between 2011 and each of the four scenarios (shown as those pixels that changed or did not change), and the change in ecosystem services value from the 2011 values to each of the four scenarios within that country or region. This figure shows which areas of each country or region will be most affected in the future and how the ecosystem services in that area will change. Such information provides policy makers with the knowledge they need to ensure that the biomes that are most at risk and the most valuable within those countries are protected.

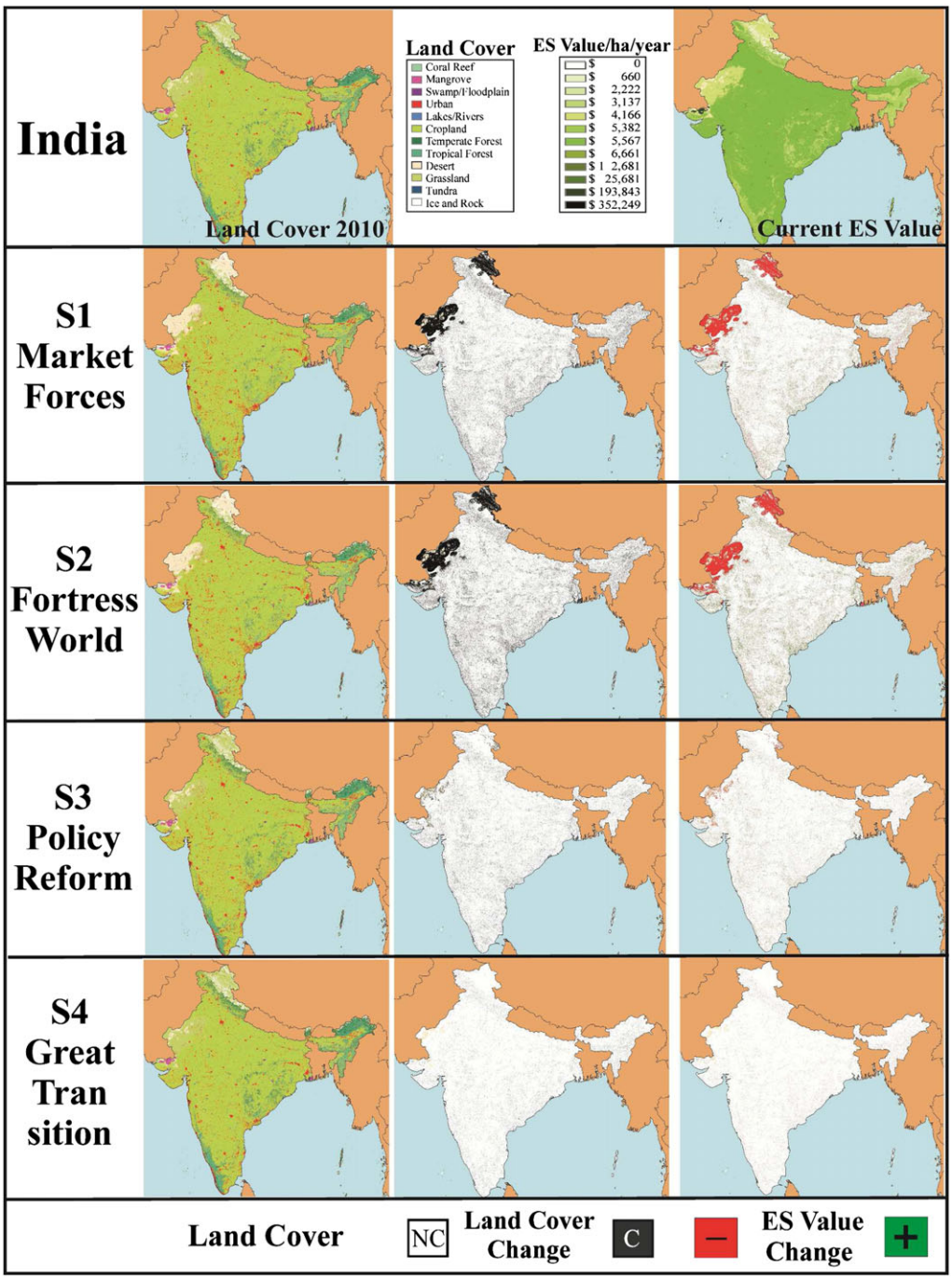
4.3. Comparison With a National Study

In 2013, a national study of the Kingdom of Bhutan found that the total ecosystem services value was USD $15.5 billion/year (Kubiszewski et al. 2013). Our current global study determined that the total ecosystem services value of the same area was USD $14.9 billion/year, only a 4% difference even though the two studies varied in several ways.

Below are some of the primary differences between the two studies.

- **Resolution.** The global model has a one-kilometer resolution while the national study was at a much finer resolution (Figure 3). Using a one-kilometer resolution implies that if any part of the pixel that touches the Bhutanese border is counted, even if only a small percentage of the one-kilometer pixel is in Bhutan itself. Resolution and pixel inclusion is partially responsible for the difference in Bhutan's land area in the two studies.

Figure 2 (Continued)



In the global study the total land area for Bhutan used was 3.998 million hectares while in the national study it was 3.870 million hectares, a difference of 128 thousand hectares. Resolution also makes a difference in the biomes detected in the model.

Figure 2 (Continued)

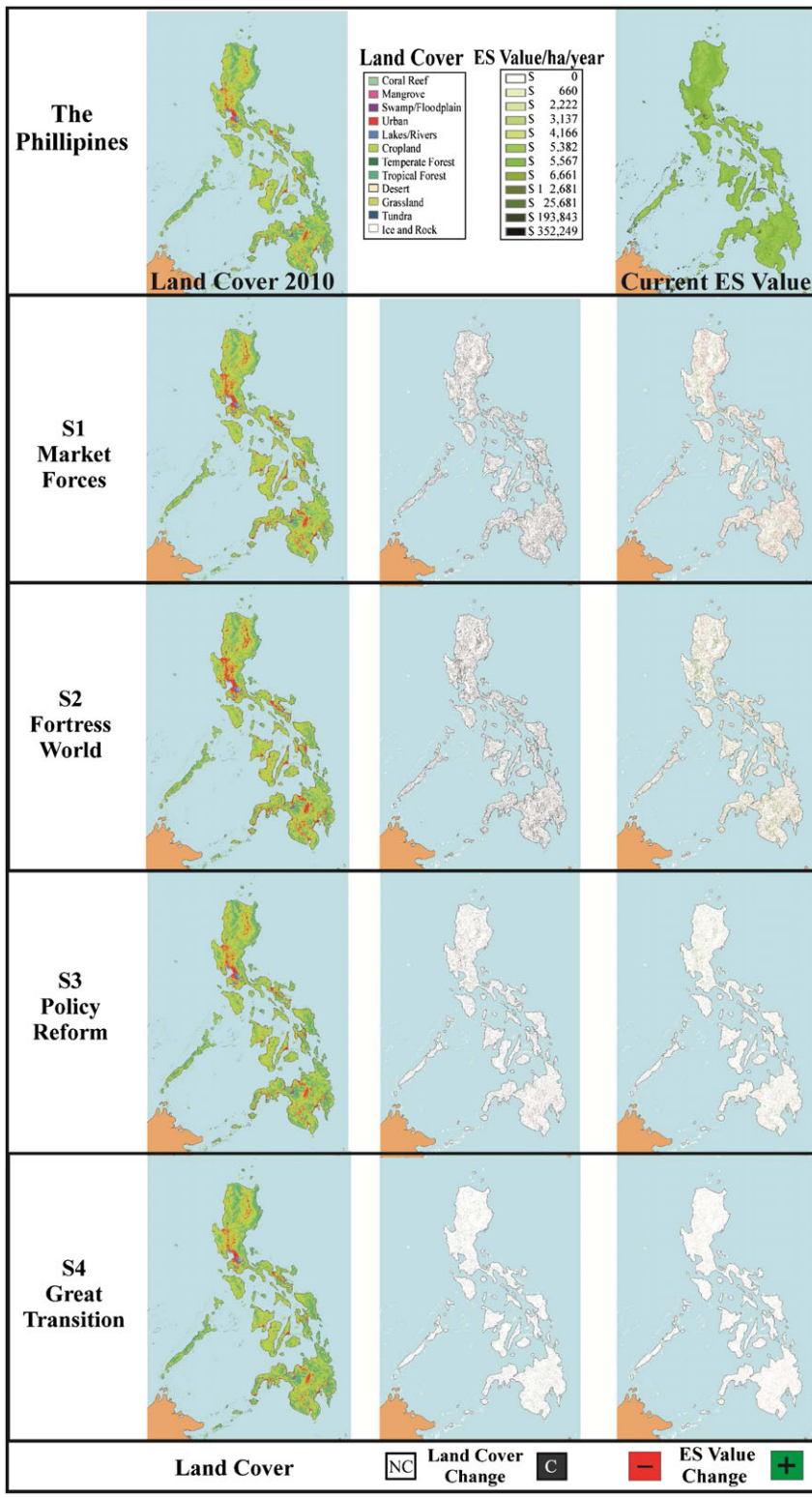


Figure 2 (Continued)

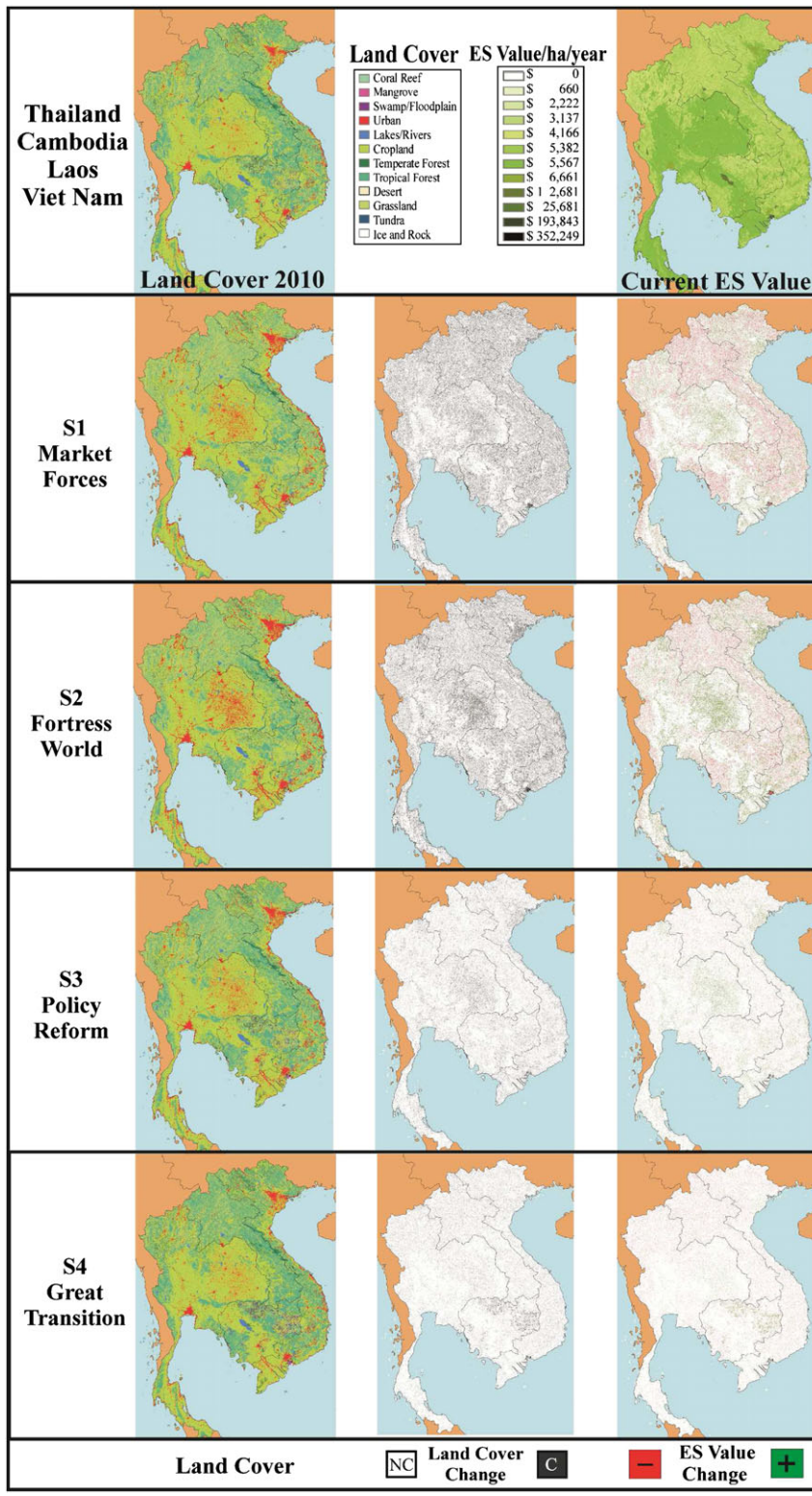
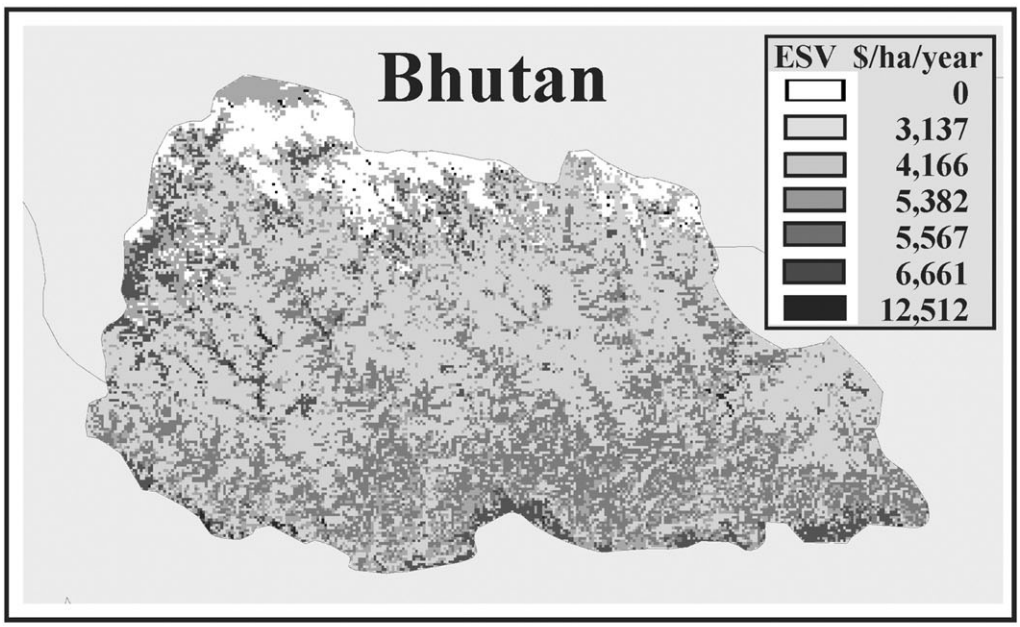
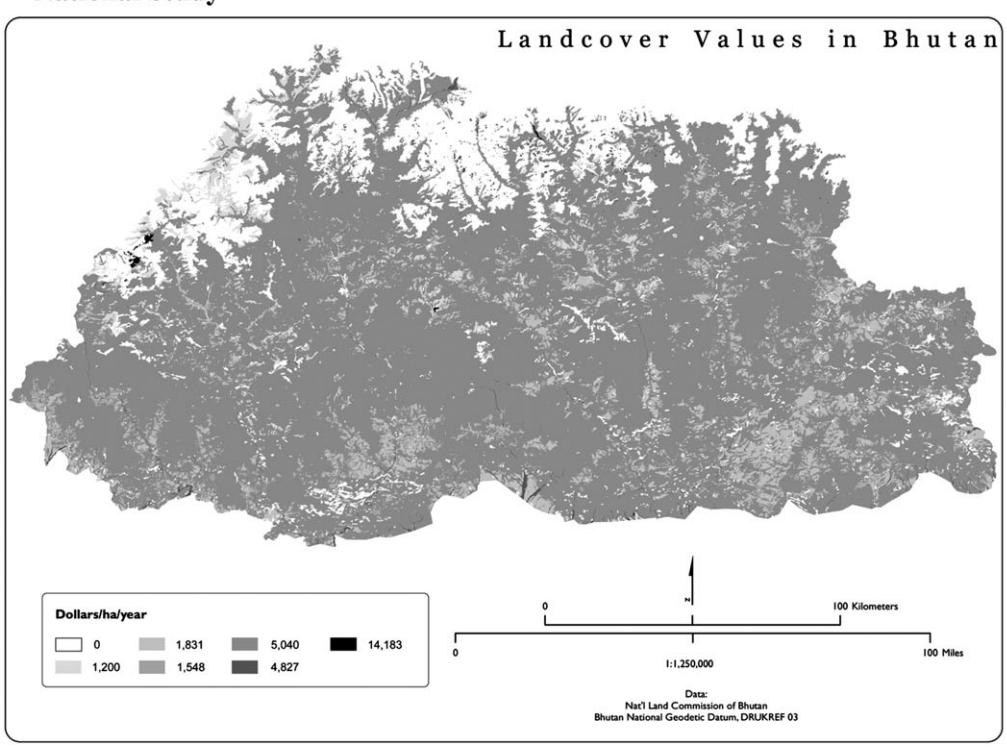


Figure 3 Two maps of Bhutan both showing the total ecosystem services value of the country. Top: Total ecosystem services value map produced by the global model used in this study to value ecosystem services globally. Bottom: Total ecosystem services value map used in the 2013 national study of Bhutan

Global Model



National Study



Although the national study found 3,528 hectares of inland wetlands in Bhutan, they are all smaller than 1 km^2, meaning that the global study did not pick up any wetlands in Bhutan.

- **Data Source.** The data from the global model came from a remote sensing study, which used satellite images to identify the biomes based on how they looked from space. This method sometimes has a hard time distinguishing between similar biomes. For example, the global study shows 804,000 hectares of tropical forests in Bhutan, even though all of Bhutan's forests are temperate. On the other hand, the land cover data from the national study was government data that had been extensively ground truthed.
- **Unit Values.** In both studies, the unit values for each square kilometer of biome were derived through the use of benefit transfer. In the national study, all transferred values were carefully vetted to ensure that they were from regions similar in climate, quality, and other characteristics before averaging. The global model averaged values from all over the world, making them less specific to Bhutan itself. For example, temperate forests cover almost 75% of Bhutan's land area. In the national study, temperate forests were valued at USD $5,040 per hectare per year while in the global study, temperate forests were valued at USD $3,137 per hectare per year. With a difference of USD $1,903 per hectare per year, this creates a difference of almost USD $5.5 billion per year for the total ecosystem service value of Bhutan. This difference is much greater than the difference between the total ecosystem service values we found between the two studies, showing that other differences between the studies also impact the total value.

5. Conclusions

The Asia and Oceania regions are at a stage of development where the policy decisions made in the near future will have huge impacts on environmental and social well-being, not only of these countries but for the entire world. The impacts on the production of ecosystem services in the four scenarios we evaluated can be anywhere from a decrease of USD $4.7 trillion per year (a loss of USD $1.2 trillion/yr in Oceania and USD $3.5 trillion/yr in Asia) to an increase of USD $3.3 trillion per year (a gain of USD $844 billion/yr in Oceania and USD $2.4 trillion/yr in Asia). This is significantly larger than most of these countries' GDPs. Policies that would create the Fortress World or the Market Forces scenarios would have the greatest impact on the poorest (Fisher et al. 2014). It is the poorest in any society that have the highest dependence on direct ecosystem services and are the first to feel the affects when those ecosystem services begin to disappear. The Great Transition scenario, on the other hand, would allow natural capital in these countries to thrive, increasing human well-being (Kubiszewski et al. 2013; Costanza et al. 2014).

The Great Transition scenario is also consistent with the recently adopted UN Sustainable Development Goals (SDG's) (United Nations 2015). All the countries in the region have agreed to meet the SDGs. The GT scenario estimates the value of ecosystem services that will occur if these countries achieve the SDGs. The alternative MF and FW scenarios produce a significant decline in ecosystem services and human wellbeing more broadly. The time has surely come to move away from the narrow focus on GDP growth that has drive past development policies and toward a more balanced set of goals like the SDG's that can restore ecosystem services and improve sustainable wellbeing.

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