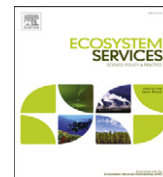




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An initial estimate of the value of ecosystem services in Bhutan

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ABSTRACT

We estimated the value of ecosystem services in Bhutan using benefit transfer methodology in order to determine an initial assessment of their overall contribution to human well-being. The total estimated value was approximately \$15.5 billion/yr (NU760 billion/yr), significantly greater than the gross domestic product (GDP) of \$3.5 billion/yr.

We also estimated who benefits from Bhutan's ecosystem services. 53% of the total benefits accrue to people outside Bhutan. 47% of the benefits accrue to people inside the country—15% at the national level, and 32% at the local level. Based on this and a population of 700,000 we estimated Bhutan's combined per capita annual benefits at \$15,400/capita/yr. Of this \$5000 is from goods and services captured in GDP and \$10,400 is from ecosystem services. This is only a partial estimate that leaves out other sources of benefits to people, including social and cultural values.

This study is the first phase of a larger, multiyear project and ongoing effort in Bhutan. Subsequent phases will apply more sophisticated methods to further elaborate the value of Bhutan's ecosystem services, who benefits from them, how they can best be integrated into national well-being accounting, and how best to manage them.

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1. Introduction

Bhutan is a small (population approximately 700,000) Himalayan country whose Fourth King declared that the goal of his country's policy was "Gross National Happiness" (GNH) rather than "Gross Domestic Product" (GDP). GNH aims to integrate sustainable and equitable economic development across nine domains: psychological wellbeing, health, education, culture, time use, good governance, community vitality, ecological diversity and resilience, and living standards.

After a very interesting and unique transition to democracy initiated by the Fourth King, Bhutan is now a constitutional monarchy—much like Britain—where the King has mainly ceremonial duties. The first democratically elected Prime Minister, Lyonchoen Jigme Y. Thinley, and the elected government have set up a "Gross National Happiness Commission" (GNHC) the former Planning Commission to develop the country in accord with GNH principles. The Commission has developed a GNH policy screen based on GNH indicators, measures, and surveys developed by the Centre for Bhutan Studies, Bhutan's primary think-tank.

More than half of Bhutan's land area is under environmental protection (Ministry of Agriculture and Forest, 2012), and national policies include the goal to become the first country to produce only organic food, to be a net carbon dioxide sink in perpetuity, and to have a pedestrian Tuesday, where no cars are allowed in any major city on Tuesdays.

The Bhutanese recognize the need to move beyond GDP due to its well-known limitations as a national welfare measure and policy goal. GDP is the total market value of all final goods and services produced in a country in a given period. But GDP was never intended as a measure of well-being or progress. It is based on current prices, which are not appropriate measures of scarcity, especially of natural and social capital. It also only measures national income or economic activity and only includes those goods and services traded in markets. It also adds all economic activities together, without differentiating between those that enhance well-being and those that reduce from it. An oil spill, for example, increases GDP because of the clean up work required, but it obviously detracts from well-being. More crime, sickness, war, pollution, fires, storms, and pestilence are all potentially positives for GDP because they increase economic activity. GDP also takes no account of how the national income is distributed among the population, ignoring the fact that a dollar's worth of income produces more well-being for a poor person than a rich one.

GDP is precise but not accurate. It is precise because it is replicable; it is inaccurate (as a measure of welfare) because it

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Table 1
Ecosystem service values (ranges and means) for 9 land-cover types.

	Ref	Total area (ha)	Total area (%)	Min value (SUS/ha/year)	Max value (SUS/ha/year)	Mean value (SUS/ha/year)	Min value (SUS/year)	Max value (SUS/year)	Mean value (SUS/year)	Total value (%)
Cropland	17	309,728	8.0	\$798	\$2864	\$1831	\$224,030,375	\$887,156,484	\$567,132,576	3.7
Provisioning services				\$145	\$181	\$163	\$45,059,914	\$56,045,822	\$50,552,868	
Food	2			\$71	\$106	\$89	\$21,981,621	\$32,967,530	\$27,474,576	
Raw materials	1					\$11			\$3,296,412	
Water	1					\$64			\$19,781,880	
Regulating services				\$651	\$2649	\$1650	\$201,718,432	\$820,338,334	\$511,028,383	
Air quality	1					\$53			\$16,482,062	
Biodiversity protection	2			\$76	\$1930	\$1003	\$23,405,209	\$597,718,604	\$310,561,907	
Biological control	1					\$28			\$8,734,320	
Climate regulation	1					\$95			\$29,340,795	
Erosion prevention	2			\$51	\$135	\$93	\$15,734,164	\$41,793,874	\$28,764,019	
Pollination	1					\$19			\$5,822,880	
Soil formation	2			\$155	\$214	\$185	\$48,131,708	\$66,378,506	\$57,255,107	
Water purification	1					\$175			\$54,067,294	
Cultural services				\$1	\$35	\$18	\$330,322	\$10,772,327	\$5,551,325	
Recreation	2			\$1	\$35	\$18	\$330,322	\$10,772,327	\$5,551,325	
Orchard	9	5766	0.1			\$1548			\$8,926,944	0.1
Provisioning services						\$375			\$2,163,441	
Food	1					\$21			\$122,738	
Raw materials	1					\$141			\$813,200	
Water	1					\$213			\$1,227,503	
Regulating services						\$1103			\$6,358,456	
Air quality	1					\$229			\$1,319,556	
Biodiversity protection	1					\$232			\$1,334,899	
Climate regulation	1					\$192			\$1,104,766	
Soil formation	1					\$311			\$1,795,228	
Water purification	1					\$139			\$804,008	
Cultural Services						\$70			\$405,047	
Recreation	1					\$70			\$405,047	
Temperate forest	63	2,884,571	74.5	\$1334	\$21,715	\$5040	\$3,834,709,420	\$62,596,170,971	\$14,538,868,801	93.8
Provisioning Services				\$67	\$888	\$475	\$191,975,096	\$2,561,771,497	\$1,371,053,030	
Bioprospecting	1					\$8			\$24,184,245	
Food	4			\$0	\$432	\$242	\$599,779	\$1,247,000,114	\$697,379,641	
Genetic resources	1					\$19			\$54,229,938	
Timber	2			\$39	\$50	\$44	\$112,821,440	\$143,623,952	\$128,222,696	
Water	5			\$0	\$379	\$162	\$139,695	\$1,092,733,248	\$467,036,510	
Regulating Services				\$1264	\$13,671	\$3524	\$3,633,654,443	\$39,394,646,032	\$10,165,400,181	
Air quality	1					\$852			\$2,457,834,607	
Biodiversity protection	8			\$7	\$5192	\$969	\$19,706,381	\$14,976,693,482	\$2,795,708,992	
Biological control	2			\$5	\$14	\$9			\$27,277,513	
Climate regulation	15			\$2	\$6999	\$1220	\$6,007,590	\$20,188,808,099	\$3,518,000,805	
Erosion prevention	2			\$2	\$115	\$58	\$5,000,654	\$330,802,621	\$167,901,637	
Pollination	1					\$376			\$1,084,598,758	
Soil formation	1					\$11			\$32,537,963	
Water purification	5			\$0	\$102	\$28	\$151,152	\$295,553,161	\$81,000,079	
Water regulation	1					\$0			\$539,827	
Cultural Services				\$3	\$7155	\$1041	\$9,079,880	\$20,639,753,443	\$3,002,415,591	
Cultural values	1					\$2			\$5,422,994	
Education	1					\$0			\$1,279,944	
Science/Research	1					\$0			\$21,620	
Tourism/Recreation	11			\$1	\$7153	\$1039	\$2,355,322	\$20,633,028,885	\$2,995,691,033	
Grassland	42	151,394	3.9	\$324	\$2628	\$1200	\$49,120,964	\$397,836,830	\$181,718,223	1.2
Provisioning services				\$70	\$758	\$340	\$10,543,718	\$114,688,284	\$51,526,905	

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