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Title: **Protected areas' role in climate-change mitigation**

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Appendix S1. Evaluation of Model Uncertainties of the Terrestrial Ecosystem Model (TEM)

Consistency between model results and field measurements at specific sites is important for establishing the credibility of biogeochemistry models such as TEM. To evaluate model capabilities, we have compared our modeled estimates of net ecosystem production (NEP) to short-term measurements of net ecosystem exchange (NEE) at a number of eddy covariance sites across the globe, including ones in North America (Clein et al. 2002; Lu et al. 2013, 2015), Brazil (Tian et al. 1998) and China (Tian et al. 2011). The eddy covariance technique has been recognized as one of the most reliable approaches for estimating the net exchange of carbon dioxide between land ecosystems and the atmosphere. In these comparison studies, we ran TEM in site-specific mode, using the driving variables for the grid cell in which the field study was conducted. The model results were in reasonable agreement with the measurements for the sites, with modeled NEP estimates generally falling within +/-20 percent of the eddy flux (NEE) measurements.

At the regional scale, we have compared TEM's ability to estimate various aspects of an area's carbon budget to those estimated by inventory analyses in the Amazon Basin and by atmospheric inversion approaches in the pan-boreal region. For the Amazon Basin, the TEM estimate of mean carbon density in the forest vegetation in the 1990s was 14 kg C m^{-2} (Tian et al. 1998), which was within the range of 13.6 and 14.9 kg Cm^{-2} estimated from field surveys (Brown and Lugo 1992; Fearnside 1992). Likewise, the mean Basin soil organic carbon density of 9.3 kg Cm^{-2} (Tian et al. 1998), estimated with TEM, was close to the estimate of 10.3 kg Cm^{-2} based on the RADAM Brazil field survey (Moraes et al. 1995). The

C fluxes for the pan-boreal region simulated with TEM were within the range of uncertainty of estimates simulated by inverse calculations (Hayes et al. 2011).

Appendix S2. Protected Area

At the beginning of the 21st century, 17.2 million km^2 of the globe's total land area of about 137 million km^2 (12.6%) were designated as protected areas according to the World Database on Protected Areas (WDPA, IUCN-UNEP 2009). From this database, the protected area within each 0.5° latitude by 0.5° longitude grid cell across the globe was determined. The protected area within a grid cell was then distributed among the corresponding land cover cohorts that existed in our land-use/land-cover data set for the year 2005 based on disturbance history. Protected status was first assigned to undisturbed natural cohorts and then assigned to disturbed natural cohorts in the following order: wetlands, forests, and then non-forest land cover types (grasslands, shrublands, desert/bare ground). Within each type, protected status was first assigned to older cohorts before younger cohorts. If the WDPA data set indicated more area was protected in the grid cell than the area of natural ecosystems within the grid cell, then cohorts covered by pasture were assigned protected status. If even more area was needed, then cohorts covered by croplands were initially assigned as protected, but these cropland cohorts were later excluded from our analyses of carbon dynamics in protected lands. This allocation process resulted in the distribution of protected areas among the land cover types across EPPA regions provided in Table S1. If land covered by lakes and ice are excluded from area estimates, we estimate that protected areas cover 16.3 million km^2 or about 12.3% of the corresponding global area of 133 million km^2 (Table S2). By excluding croplands, but including pastures, we estimate that protected areas currently cover 15.5 million km^2.

To explore the effects on carbon sequestration in protected areas of projected changes in climate and land use over the 21st century, we developed two scenarios: the *Full Protection* (*FP*) scenario where no protected cohort was allowed to be converted to agriculture; and the *No Protection* (*NP*) scenario where the status of protected cohorts were ignored and these cohorts were allowed to be converted to agriculture as projected by the TEM-EPPA modeling framework (Fig. S1) in response to economic pressures. In the FP scenario, the area of protected areas in each of the EPPA regions remained constant throughout the 21st century. In the *NP* scenario, however, economic pressures caused protected areas to decrease by 36% by the end of the 21st century with most of the changes occurring in Africa and Latin America (Table S3).

Appendix S3. The Integrated Earth System Model

The linked modeling system (Fig. S1) consists of a computable general equilibrium (CGE) model of the world economy, The Emissions Predictions and Policy Analysis Model, EPPA (Paltsev et al. 2005; Gurgel et al. 2007; Reilly et al. 2012), a Terrestrial Ecosystem Model, (TEM, Felzer et al. 2004, 2005; Melillo et al. 2009) and an atmospheric chemistry and climate model. This linked modeling process captures interactions among land use, atmospheric chemistry, climate, and the economy.

Emissions Predictions and Policy Analysis (EPPA) Model.

EPPA is a recursive-dynamic multiregional computable general equilibrium (CGE) model of the world economy (Paltsev et al. 2005; Gurgel et al. 2007; Reilly et al. 2012). The model is based on the Global Trade Analysis Project (GTAP) database (Dimaranan and McDougall 2002) with the data aggregated into 16 regions (Table S4) and 25 sectors. The EPPA model projects the global economy, land use, and associated anthropogenic emissions into the future through the end of the 21st century at 5-year time steps.

In the version of the model used here (EPPA4, Paltsev et al. 2005; Gurgel et al. 2007; Wang 2008; Reilly et al. 2012), five of these sectors (Crops, Forestry, Livestock, Electric: biomass, Liquid fuel from biomass) require land inputs that have been stratified into five land classes – cropland, pastureland, managed forest land, natural grasslands, and natural forest (Gurgel et al. 2007). Land-use change, from one land class to another, depends on the prices of inputs and outputs and changing land productivities. To enable land-use change, each of the five land classes including natural forest and natural grassland has been assigned a region-specific unit price based on the Hurtt et al. (2006) data set, GTAP land-value data (Sohngen et al. 2010), and the Global Timber Market and Forestry Data Project (Sohngen 2010). The price ratio of natural forest to managed forest is then applied to the price of pastures to obtain the unit price for natural grasslands. The unit price of each land type is then used to determine changes in the land area required to support future market demand for food, biofuels, and wood products based on associated changes in land value. In the policy analysis for climate mitigation, carbon emission or uptake from land is also a factor to affect land-use change and biofuel production. To price carbon emissions from land or credit carbon uptake on land, we deal with the fundamental dynamic nature of forest carbon accounting in the recursive structure by observing that for a hectare of land

$$CarbV_{i\rightarrow j,k} = \sum_{t=k}^{m} \frac{P_{C,k}(1+\gamma)^t Carb_t}{(1+r)^t}$$

where CarbV is the net present value of the change in carbon stock for a hectare of land transition from use i to j at time k, $P_{C,k}$ is the price of carbon at time k, γ is the rate of increase in the price of carbon, r is the discount rate, $Carb_t$ is the carbon flux from or to the land at time t, and m is the number of years to an equilibrium stock level of carbon after the land use change. With banking and borrowing of allowances, γ is assumed to equal r so that the annualized rate of return used in the recursive model reduces to

$$annualizedCarbV_{i\rightarrow j,k} = (r+\delta)P_{C,k}Carb_T$$

where the annualized return is a rental rate, consisting of the sum of the discount rate and δ (where δ = 1/m) is multiplied by the price of carbon in year k and the integrated change in the carbon stock from transition i to j here labeled $Carb_T$. In general, pastureland has the lowest carbon stock, natural grassland the next lowest, then cropland, managed forest, and finally natural forest. We can then impose a system of carbon credits for uptake or require purchase of allowances for transitions that lower carbon stocks. The decision to invest in biofuels is a dynamic problem because the land-use changes needed to produce biomass result in an initial carbon debt that is eventually repaid through repeated harvests that continue to offset fossil fuel use (Melillo et al. 2009). We compare the value of emissions from using a hectare of land indefinitely to produce n biofuel crops to the value of fossil fuel emissions it would replace by determining the ratio θ

$$\theta = \sum_{t=k}^{\infty} \frac{\frac{(P_{c,k}(1+\gamma)^t * BiofuelEmissions_t)}{(1+r)^t}}{\frac{(P_{c,k}(1+\gamma)^t * GasCarb_t)}{(1+r)^t}}$$

where $BiofuelEmissions_t$ are the net land carbon emissions associated with the production of biofuels and $GasCarb_t$ are emissions from gasoline. This simplifies to

$$\theta = \sum_{t=k}^{\infty} \frac{BiofuelEmissions_t}{GasCarb_t}$$

The initial carbon debt means the net effect of biofuels is negative in the early years ($BiofuelEmissions_t > GasCarb_t$), but as emissions fall, the net effect of biofuels becomes positive ($BiofuelEmissions_t < GasCarb_t$). We credit biofuels production equal to (1-θ) per GJ of biofuel used when land carbon is priced.

Dynamic Linkage between EPPA and TEM

Climate policy, land-use changes, energy production, and economic activities are highly interactive. To account for these interactions and feedbacks, a dynamic linkage between EPPA and TEM has been developed for passing information on changes in land productivities and land management iteratively between the two models (Fig. S1). Changes of net primary productivity, simulated by TEM, are used to represent the changes of land productivity due to changing climate and the levels of CO_2 and O_3. The change of land productivity is one of the important factors to affect land use and land-use changes in EPPA. Because the EPPA model simulates the global economy using a 5-year time step, and the TEM estimates carbon and nitrogen fluxes on a monthly step, the dynamic linkage between EPPA and TEM are developed on a five-year basis. The linkage consists of five steps. First, TEM runs for five years using known information on climate and atmospheric composition estimated from an atmospheric chemistry and climate model and an initial land cover and management from Hurtt et al. (2006) to determine monthly net primary production (NPP) for this initial 5-year time period. Second, the monthly NPP estimates from TEM are aggregated to 5-year mean annual NPP values for each of the EPPA land sectors in each of the EPPA regions and for each grid cell for later downscaling. Third, the EPPA model uses the aggregated NPP estimates from TEM to predict changes in the land shares for each of the EPPA regions. Fourth, the changes in land shares in each of the EPPA regions are then downscaled to the 0.5° latitude ° by 0.5° longitude spatial resolution using a statistical approach based on climate and gridded 5-year mean NPP estimates and mapped to the land classes used by TEM (Schlosser et al. 2007; Melillo et al. 2009). Fifth, the projected land cover obtained from the downscaling is then used along with updated climate data from the atmospheric chemistry and climate model to run TEM to estimate NPP for the next five years. This procedure linking TEM to EPPA continues for each 5-year time step throughout the 21st century.

Appendix S4. Evaluation of Model Uncertainties of the Economic Projection and Policy Analysis (EPPA) Model

Key uncertainties related to land conversion costs, representation of the willingness to convert land, the ability to substitute other inputs for land, food consumption patterns with changing income, competition of land for food, timber, bioenergy and recreation, and yield growth trends have been extensively evaluated in formulating the EPPA land use component (Gurgel et al. 2007, 2011; Antoine et al. 2008; Melillo et al. 2009; Gitiaux, et al. 2011; Chen et al. 2015; Winchester and Reilly 2015). These various data, structural and parametric uncertainties contribute substantial uncertainty to future projections (Melillo, et al. 2009; Sokolov et al. 2009; Gurgel et al. 2011; Webster et al. 2012; Flato et al. 2013; Schmitz et al. 2014), but as is the case with any earth system projection exercise, the projections in this paper are illustrative of potential risks to protected areas.

Appendix S5. Evaluation of Model Uncertainties of the MIT Earth System Model (MESM)

The MESM has been tested in a variety of ways including in a hindcasting comparison of earth system models of intermediate complexity done in preparation for IPCCV (Eby et al. 2013). For the specified external forcings over the 20th century, the MESM was one of five models out of the fifteen models involved in the comparison that, when simulating air surface temperature, stayed within the observational uncertainty envelope for this period (Figure 2b in Eby et al. 2013). This hindcasting test helps to build confidence in our integrated modeling approach that is the foundation of our 21st century climate projections.

The model is computationally efficient and flexible, allowing it to represent parametrically the range of earth system responses as they vary due to structural differences among more highly resolved atmospheric-ocean general circulation models. This also allows the use of an optimal fingerprint method to be applied to historical atmosphere and ocean data to estimate joint distributions for parameter uncertainty and a best-fit estimate of climate sensitivity, ocean heat uptake, and aerosol effectiveness (Forest et al. 2006, 2008). The joint distribution identified combinations of parameters that fit the historical climate patterns and ocean heat uptake within the range of uncertainty in the data and given natural variability.

Appendix S6. Carbon Sequestration Calculations

To determine changes in carbon sequestration within protected areas over the 21st century, we compared carbon sequestration rates for the five-year periods of 2005 to 2010 and 2095 to 2100. Within each 0.5° latitude by 0.5° longitude grid cell, carbon sequestration rates were determined for each protected cohort for each period. First, estimates of December vegetation carbon stocks were added to estimates of December soil organic carbon stocks to obtain estimated of December total carbon stocks for the years 2005, 2010, 2095 and 2100. Next, the December total carbon stocks in 2005 were subtracted from the December total carbon stocks in 2010 and the difference was divided by five to obtain the carbon sequestration rate of the protected cohort at the beginning of the 21st century. Then, the December total carbon stocks in 2095 were subtracted from the December total carbon stocks in 2100 and the difference was divided by five to obtain the carbon sequestration rate of the protected cohort at the end of the 21st century. The cohort carbon sequestration rates were then summed across all protected cohorts for all grid cells within an EPPA region to obtain current carbon sequestration rates (Table S5) and carbon sequestration rates at the end of the 21st century under the *Full Protection* (*FP*) scenario where the integrity of the protected areas are fully maintained (Table S6) and under the *No Protection* (*NP*) scenario where development in protected areas is allowed to occur (Table S7).

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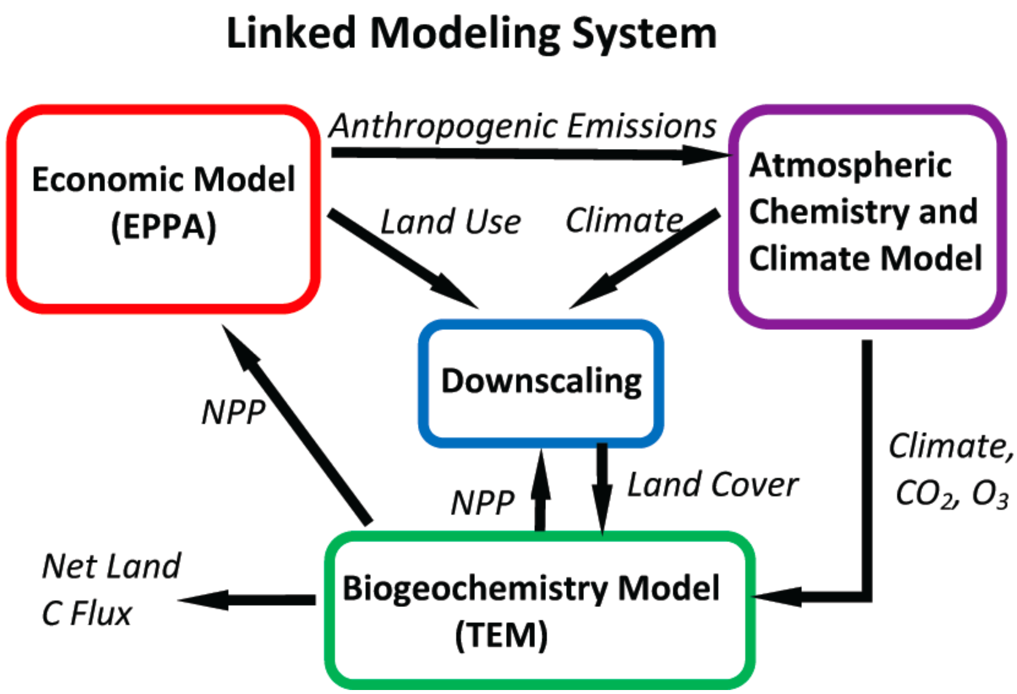

Fig. S1. The dynamically linked modeling system. It consists of an economic model (EPPA), a terrestrial biogeochemistry model (TEM) using climate output from an atmospheric chemistry and climate model (Reilly et al. 2012).

Table S1. Distribution of designated protected area (million km²) among land covers within EPPA regions in 2005.

Region	Undist. Forests	Disturbed Forests	Shrubs	Grass	Wetlands	Deserts	Pastures	Crops	Lakes	Ice	Total
AFR	0.30	0.93	0.27	0.66	0.27	0.62	1.00	0.10	0.02	0.00	4.17
ANZ	0.04	0.09	0.19	0.04	0.02	0.00	0.40	0.01	0.00	0.00	0.79
ASI	0.03	0.03	0.00	0.01	0.01	0.00	0.00	0.06	0.00	0.00	0.14
CAN	0.13	0.14	0.03	0.00	0.19	0.04	0.00	0.01	0.03	0.03	0.60
CHN	0.07	0.11	0.03	0.04	0.20	0.64	0.22	0.04	0.01	0.00	1.36
EET	0.01	0.08	0.00	0.00	0.01	0.00	0.02	0.02	0.00	0.00	0.14
EUR	0.11	0.29	0.02	0.02	0.03	0.01	0.06	0.05	0.00	0.01	0.60
FSU	0.42	0.32	0.15	0.07	0.34	0.08	0.17	0.08	0.05	0.00	1.68
IDZ	0.08	0.03	0.00	0.00	0.03	0.00	0.01	0.05	0.00	0.00	0.20
IND	0.03	0.08	0.01	0.02	0.00	0.00	0.00	0.06	0.00	0.00	0.20
JPN	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
LAM	1.66	1.07	0.02	0.34	0.23	0.10	0.61	0.23	0.01	0.00	4.27
MES	0.02	0.03	0.03	0.04	0.00	0.33	0.26	0.00	0.00	0.00	0.71
MEX	0.01	0.07	0.06	0.01	0.01	0.00	0.06	0.00	0.00	0.00	0.22
ROW	0.07	0.07	0.05	0.07	0.02	0.05	0.12	0.09	0.00	0.70	1.24
USA	0.11	0.27	0.07	0.03	0.14	0.10	0.06	0.04	0.03	0.01	0.86
Globe	3.10	3.65	0.93	1.35	1.50	1.97	2.99	0.84	0.15	0.75	17.23

Table S2. Distribution of global protected areas (million km^2) among natural and human-disturbed land covers.

Land Cover	Natural	Human-Disturbed
Forests	3.1	3.6
Grasslands	1.4	
Shrublands	0.9	
Wetlands	1.5	
Desert/Bare ground	2.0	
Rangelands/Pastures		3.0
Croplands		0.8
Lakes	0.2	
Ice/Glaciers	0.7	

Table S3. Potential loss of protected areas by the end of the 21st century in the *NP* scenario, in which the extent of protected areas is reduced in response to land-use pressures from a growing and wealthier world population.

Region	Current (10^6 ha)	Future (10^6 ha)	Change (10^6 ha)	% of Global Change
Africa	4.1	2.1	-2.0	35.7
Latin America	4.0	2.5	-1.5	26.8
Former Soviet Union	1.5	1.1	-0.4	7.1
Australia/New Zealand	0.8	0.4	-0.4	7.1
China	1.3	1.1	-0.2	3.6
United States of America	0.8	0.6	-0.2	3.6
Eastern Europe	0.5	0.3	-0.2	3.6
Mexico	0.2	0.1	-0.1	1.8
Canada	0.5	0.4	-0.1	1.8
Middle East	0.7	0.6	-0.1	1.8
India	0.2	0.1	-0.1	1.8
Indonesia	0.2	0.1	-0.1	1.8
European Union	0.1	0.1	0.0	0.0
Higher Income Asia	0.1	0.1	0.0	0.0
Japan	0.0	0.0	0.0	0.0
Rest of the World	0.5	0.3	-0.2	3.5
Globe	15.5	9.9	-5.6	100.0

Table S4. Association of EPPA4 regions to countries and territories across the globe.

EPPA region	Countries and Territories
AFR	Algeria, Angola, Benin, Botswana, Burkino Faso, Burundi, Cameroon, Canary Islands, Cape Verde, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Europa Island, Gabon, Gambia, Ghana, Glorioso Islands, Guinea, Guinea-Bissau, Ivory Coast, Juan De Nova Island, Kenya, Lesotho, Liberia, Libya, Madagascar, Madeira, Malawi, Mali, Mauritania, Mauritius, Mayotte, Morocco, Mozambique, Namibia, Niger, Nigeria, Republic of Congo, Reunion, Rwanda, Saint Helena, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Tromelin Island, Tunisia, Uganda, Western Sahara, Zambia, Zimbabwe
ANZ	Australia, Cook Islands, New Zealand, Niue, Norfolk Island, Tokelau
ASI	Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand
CAN	Canada
CHN	China, Hong Kong, Paracel Islands
EET	Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia
EUR	Austria, Belgium, Denmark, Faroe Islands, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom
FSU	Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan
IDZ	Indonesia, Timor Leste
IND	India
JPN	Japan
LAM	Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti. Honduras, Jamaica, Martinique, Montserrat, Netherland Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, Venezuela, Virgin Islands
MES	Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestinian Territories, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen
MEX	Mexico
ROW	Afghanistan, Albania, American Samoa, Bangladesh, Bhutan, Bosnia-Herzegovina, British Indian Ocean Territory, Brunei, Cambodia, Croatia, Cyprus, Fiji, French Polynesia, French Southern and Antarctic Lands, Futuna Island, Greenland, Guam, Kiribati, Laos, Macedonia, Maldives, Marshall Islands, Micronesia, Mongolia, Montenegro, Myanmar, Nauru, Nepal, New Caledonia, Northern Mariana Islands, North Korea, Pakistan, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Serbia, Solomon Islands, Sri Lanka, South Georgia Island, Tonga, Turkey, Tuvalu, Vanuatu, Vietnam, Wallis Island
USA	United States of America

Table S5. Distribution of vegetation, soil, and total organic carbon stocks (Pg C) and changes in those carbon stocks (Pg C/yr) in protected areas among EPPA regions between 2005 and 2010.

Region	Vegetation			Soil			Total		
	2005 (Pg C)	2010 (Pg C)	ΔVeg C (Pg C/yr)	2005 (Pg C)	2010 (Pg C)	ΔSoil C (Pg C/yr)	2005 (Pg C)	2010 (Pg C)	ΔTotal C (Pg C/yr)
AFR	10.924	11.287	0.073	20.178	20.132	-0.009	31.102	31.419	0.063
ANZ	1.162	1.203	0.008	4.252	4.276	0.005	5.414	5.479	0.013
ASI	0.907	1.003	0.019	0.927	0.900	-0.005	1.834	1.903	0.014
CAN	2.652	2.725	0.015	8.800	8.783	-0.003	11.452	11.508	0.011
CHN	2.510	2.583	0.015	10.853	10.814	-0.008	13.363	13.397	0.007
EET	0.989	1.022	0.007	1.493	1.492	0.000	2.482	2.514	0.006
EUR	3.899	4.139	0.048	6.646	6.634	-0.002	10.545	10.773	0.046
FSU	7.019	7.249	0.046	25.549	25.449	-0.020	32.568	32.698	0.026
IDZ	2.848	2.937	0.018	2.180	2.158	-0.004	5.028	5.095	0.013
IND	0.773	0.833	0.012	1.126	1.097	-0.006	1.899	1.930	0.006
JPN	0.566	0.583	0.003	0.558	0.558	0.000	1.124	1.141	0.003
LAM	50.925	52.182	0.251	47.706	47.700	-0.001	98.631	99.882	0.250
MES	0.175	0.179	0.001	0.655	0.656	0.000	0.830	0.835	0.001
MEX	0.592	0.629	0.007	1.162	1.161	0.000	1.754	1.790	0.007
ROW	1.559	1.639	0.016	3.383	3.359	-0.005	4.942	4.998	0.011
USA	4.741	4.913	0.034	10.111	10.106	-0.001	14.852	15.019	0.033
Globe	92.241	95.106	0.573	145.579	145.275	-0.059	237.82	240.381	0.510

Table S6. Distribution of vegetation, soil, and total organic carbon stocks (Pg C) and changes in those carbon stocks (Pg C/yr) in protected areas among EPPA regions between 2095 and 2100 under the *FP* scenario.

Region	Vegetation			Soil			Total		
	2095 (Pg C)	2100 (Pg C)	ΔVeg C (Pg C/yr)	2095 (Pg C)	2100 (Pg C)	ΔSoil C (Pg C/yr)	2095 (Pg C)	2100 (Pg C)	ΔTotal C (Pg C/yr)
AFR	13.509	13.664	0.031	20.183	20.154	-0.006	33.692	33.818	0.025
ANZ	1.615	1.644	0.006	4.512	4.516	0.001	6.127	6.160	0.007
ASI	1.321	1.336	0.003	0.915	0.915	0.000	2.236	2.251	0.003
CAN	3.798	3.877	0.016	9.072	9.093	0.004	12.870	12.970	0.020
CHN	3.232	3.281	0.010	10.712	10.734	0.004	13.944	14.015	0.014
EET	1.348	1.377	0.006	1.482	1.483	0.000	2.830	2.860	0.006
EUR	5.938	6.080	0.028	6.712	6.716	0.001	12.650	12.796	0.029
FSU	10.516	10.749	0.047	25.578	25.598	0.004	36.094	36.347	0.051
IDZ	3.415	3.449	0.007	2.159	2.157	0.000	5.574	5.606	0.006
IND	1.094	1.109	0.003	1.072	1.073	0.000	2.166	2.182	0.003
JPN	0.758	0.772	0.003	0.563	0.563	0.000	1.321	1.335	0.003
LAM	60.118	60.692	0.115	47.576	47.487	-0.018	107.694	108.179	0.097
MES	0.277	0.284	0.001	0.714	0.718	0.001	0.991	1.002	0.002
MEX	0.824	0.836	0.002	1.173	1.174	0.000	1.997	2.010	0.003
ROW	2.093	2.123	0.006	3.320	3.323	0.001	5.413	5.446	0.007
USA	6.281	6.377	0.019	10.310	10.328	0.004	16.591	16.705	0.023
Globe	116.137	117.650	0.303	146.053	146.032	-0.004	262.190	263.682	0.299

Table S7. Distribution of vegetation, soil, and total organic carbon stocks (Pg C) and changes in those carbon stocks (Pg C/yr) in protected areas among EPPA regions between 2095 and 2100 under the *NP* scenario.

Region	Vegetation			Soil			Total		
	2095 (Pg C)	2100 (Pg C)	ΔVeg C (Pg C/yr)	2095 (Pg C)	2100 (Pg C)	ΔSoil C (Pg C/yr)	2095 (Pg C)	2100 (Pg C)	ΔTotal C (Pg C/yr)
AFR	5.774	5.784	0.002	12.789	12.657	-0.026	18.563	18.441	-0.024
ANZ	0.859	0.854	-0.001	3.261	3.234	-0.005	4.120	4.088	-0.006
ASI	0.781	0.788	0.001	0.673	0.674	0.000	1.454	1.462	0.002
CAN	2.812	2.874	0.012	8.417	8.429	0.002	11.229	11.303	0.015
CHN	2.071	2.097	0.005	9.358	9.380	0.004	11.429	11.477	0.010
EET	0.986	1.005	0.004	1.251	1.248	-0.001	2.237	2.253	0.003
EUR	3.422	3.467	0.009	5.339	5.312	-0.005	8.761	8.779	0.004
FSU	6.932	7.070	0.028	21.895	21.891	-0.001	28.827	28.961	0.027
IDZ	2.681	2.683	0.000	1.850	1.843	-0.001	4.531	4.526	-0.001
IND	0.599	0.582	-0.003	0.825	0.814	-0.002	1.424	1.396	-0.006
JPN	0.564	0.573	0.002	0.466	0.466	0.000	1.030	1.039	0.002
LAM	44.366	44.291	-0.015	38.150	38.043	-0.021	82.516	82.334	-0.036
MES	0.228	0.233	0.001	0.604	0.606	0.000	0.832	0.839	0.001
MEX	0.366	0.369	0.001	0.723	0.722	0.000	1.089	1.091	0.000
ROW	1.393	1.406	0.003	2.592	2.591	0.000	3.985	3.997	0.002
USA	3.880	3.918	0.008	8.479	8.490	0.002	12.359	12.408	0.010
Globe	77.714	77.994	0.057	116.672	116.400	-0.054	194.386	194.394	0.003