Green Giant or Straw Man? Environmental Pressure and Civil Conflict, 1961–99

Helga Malmin Binningsbø, Indra de Soysa, and Nils Petter Gleditsch

Department of Sociology and Political Science, Norwegian University of Science and Technology (NTNU), Trondheim, Norway & Centre for the Study of Civil War (CSCW) at the International Peace Research Institute, Oslo (PRIO)

Paper presented to the 47th Annual Convention of the International Studies Association, San Diego, CA, 22–25 March 2006, Panel: Resource Scarcity and Armed Conflict, WC04 Wednesday 1:45 - 3:30 PM

The proposition that environmental scarcity causes violent conflict attracts both popular and academic interest. Neomalthusian writers have a well-developed theoretical argument explaining this connection, and have conducted numerous case studies that seem to support such a view. So far there have been few systematic quantitative or comparative studies, and the few that exist have focused on particular forms of environmental degradation or on a small subset of resources, particularly mineral wealth. We test a more general argument about the effects of resource scarcity by examining two different indicators of environmental sustainability: the Ecological Footprint and the World Bank's Genuine Savings index. Neomalthusian reasoning would lead us to expect that a higher ecological footprint should experience greater scarcities and thus a higher level of conflict. Yet, we find that countries with a heavier footprint have a substantially greater chance of peace. On the face of it, neomalthusian arguments might be supported by the findings that a higher ecological reserve and bio-capacity also predicts peace. Substantively, however, the negative effect of the footprint on conflict is much stronger than the negative effect of bio-capacity and ecological reserve. Moreover, the capacity and reserve effects are fragile relative to the ecological footprint's effects. Our findings support the link between consumption, development, and peace, rather than the neomalthusian proposition. Since poorer countries are at highest risk of conflict, these results pose a cruel dilemma because reducing risk would entail increasing bio-capacity (increase size of national territory) or reducing the footprint, the only feasible option. Since poor countries, which show highest risk of conflict, already contain the lowest footprints, then peace without ecological damage will have to be bought by transferring consumption opportunities from rich to poor. Despite the prominence of measures such as the ecological footprint in shaping policy, our results suggest that they are problematic when it comes to demonstrating a link between environmental scarcity and the risk of civil war.

Our work on this paper has been supported by the Research Council of Norway. We are also grateful to the Global Footprint Network for making their data available. Earlier versions of the paper were presented at the 101st Annual Meeting of the American Political Science Association, Washington, DC, 1–4 September 2005 and the Third General Conference of the European Consortium for Political Research, Budapest, 8–10 September 2005. Our data will be made available upon publication at PRIO's replication data page, www.prio.no/cscw/datasets. HELGA MALMIN BINNINGSBØ is a PhD student in political science at the Norwegian University of Science and Technology (NTNU) in Trondheim and Research Associate of the Centre for Study of Civil War (CSCW) at the International Peace Research Institute, Oslo (PRIO). INDRA DE SOYSA is Associate Professor of political science at NTNU and Research Associate at CSCW. NILS PETTER GLEDITSCH is Research Professor at CSCW, editor of *Journal of Peace Research,* and Professor of political science at NTNU.

Introduction

Many scholars concerned with the environment see global environmental change as a security issue (Brauch, 2003; Cassils, 2004; Diamond, 2005; Homer-Dixon, 2000; Renner, 1996).[1] This view is very widely shared among advocacy groups, and large segments of the popular media. The prevailing notion is that growing environmental scarcity, particularly the scarcity of arable land and other renewable natural resources, perpetuate underdevelopment and promote violent conflict. Profligate consumption in the rich countries contributes to environmental pressure globally, and the adoption of industrial-country practices among the poor exacerbates the pressure, leading eventual to societal collapse and violent conflict. We investigate this proposition by relying on two broad measures of ecological pressure at the country level, particularly focusing on the ecological footprint (EF) and its components (Wackernagel and Rees, 1996; WWF, 2004). This indicator gauges a country's current consumption of ecoservices relative to capacity (Wackernagel et al., 1999). In addition, we also examine the adjusted net savings (genuine savings) measure of sustainability (Hamilton et al., 2000). We relate these two measures to small armed conflicts as well as conflicts large enough to be classified as wars. We rely on a model of civil war from a prominently-published and frequently-cited study (Fearon and Laitin, 2003).

Indicators of environmental pressure, sustainability of resources, and degradation are not uncontroversial (Neumayer, 2004). Without touching the heat of those debates, we concentrate mainly on the EF and its components, which are stock measures that capture environmental capacity for sustaining current levels of consumption (human use).[2] We also use the World Bank's measure of Adjusted Net Savings (or genuine savings), which is largely a flow measure, to capture aspects of current environmental degradation and investment (de Soysa and Neumayer, 2005; Hamilton et al., 2000).[3] Our results are easily summarized: Contrary to neomalthusian views, a higher ecological footprint is negatively correlated with conflict onset, controlling for income effects and other factors. However, in line with neomalthusian expectations, higher bio-capacity per capita and a higher bio-capacity to footprint ratio predicts peace, although the result is somewhat fragile. If this correlation is to be taken seriously, the implications pose a cruel dilemma. Poor countries are the most at risk of conflict, but they have the lowest footprints. The only way in which they could increase their reserve is to annex territory or decrease their consumption, waste generation, and production, clearly untenable positions. Paradoxically, peace is achieved with heavier footprints, and it is the poor that tread the lightest.

---

[1] See Nordås and Gleditsch (2005) for an evaluation of arguments linking climate change to conflict.
[2] A stock measure captures aspects of scarcity relative to needs much better than flow, since flows are annual indicators that may not capture aspects of total availability.
[3] We discuss each of our indicators in detail below.

Theory

The domination of the earth by man is apparently progressing at unprecedented rates (MEA, 2003; Vitousek et al., 1997). The state of the environment is gaining increasing attention, and 'environmental security' is integrated into broader concepts of security, such as collective security (Panyarachun, 2004) or human security (Nordås and Gleditsch, 2005; Page and Redclift, 2002). This perspective on conflict won many policy converts in the Clinton administration, whose UN Ambassador expressed the view that 'We believe that environmental degradation is not simply an irritation but a real threat to our national security'.[4] The Nobel Peace Prize for 2004 was given to an environmentalist on the widespread belief that good environmental stewardship relates to peace and human security.[5] And a report by the Millennium Ecosystem Assessment, which combined the minds of leading natural and social scientists from across the globe, argues that 'environmental stresses heighten tensions, leading to possible conflict' (MEA 2003: 79).[6] With increasing concern about the global effects of climate change – widely believed to increase environmental scarcities through mechanisms such as sea level rise, drought, and hurricanes – conflict is often invoked as a possible scenario (Schwartz and Randall 2003). On the face of it, the environmental pressure-civil conflict nexus emerges as a green giant in the field of conflict studies. Others suggest that theory relating to ecological factors as causes of violent conflict is a straw man.

Two schools of thought dominate the theoretical battle for answering the environmental conflict issue (de Soysa, 2005; Gleditsch, 1998, 2003).[7] The neomalthusians, inspired by Thomas Malthus' proposition that population increases geometrically, while food production only grows arithmetically, believe that with rising population pressure the planet will run out of resources for the sustenance of society. Population growth will lead to over-consumption of resources, resource degradation, and finally scarcities, resulting in violent competition. With scarce resources, people will fight for survival (Homer-Dixon, 1999; Renner, 1996). The most widely publicized neomalthusian scenario, *The Limits to Growth* (as well as the recent *30-Year Update*) have warned of impending environmental collapse unless dramatic remedial action is taken.[8] The celebrated biologist, Jared Diamond (2005) also cautions that environmental decline could lead to collapse, and the fate of Easter Island and the Norse settlements in Greenland are invoked as reminders of the fate for those who ignore environmental pressures. His conclusions, however, are nuanced in that today's

---

[4] Madeleine Albright, 21 April 1994, cited in Peluso and Watts, 2001: 7).
[5] Cf. www.nobel.no/eng_lau_announce2004.html. For a critical view of the Nobel Committee's reasoning, see Gleditsch and Urdal (2004).
[6] The MEA cites the work of Thomas Homer-Dixon in support of their claims. We will also concentrate largely on Homer-Dixon's work below.
[7] See also Dryzek (1987) for discussion of the various environmental discourses.
[8] Meadows et al. (1972, 2004). For a critical review, see Smil (2005).

situation may in fact be very different because of increased potential for transport and trade and the technological tools available for adaptation. Nevertheless, the collapse of such societies as Rwanda, Somalia, and Haiti are highlighted for their ecological scarcities, not on more immediate factors based on economic, cultural, and political issues. Diamond, like many others, maintains that ecological collapse is the ultimate source of other failures. Thus, climate change and increased levels of consumption may exacerbate the underlying ecological conditions that determine social failure and collapse.

The cornucopians, on the other hand, have a more optimistic view of the environmental situation, and perhaps of human nature. While most of them acknowledge that environmental degradation poses periodic challenges to human well-being, they emphasize the role of new technology, human ingenuity, market pricing, and cooperation in overcoming scarcity (Lomborg, 2001; Simon, 1998). Some argue that it is precisely because of a lack of pressure that resource-abundant countries fail to adopt best practices in economic and political life (Boserup 1965). Natural resources may be even a curse rather than a blessing (Ross, 1999; Sachs and Warner, 2001). But the debates between those who see natural resource scarcity driving conflict and those who suggest that natural resource abundance is most to blame have focused primarily on specific natural resources (both renewable and non-renewable), not on a broader ecological base, such as we do here.

Much of the work in this area is polemical and few studies have brought systematic evidence to bear on the question of environmental pressure and conflict, particularly by examining effects over time. Strong proponents of the resource scarcity school have claimed, on the basis of case studies of violent societies, that 'environmental scarcity causes violent conflict' (Homer-Dixon 1999: 53). These studies have been criticized for selection on the dependent variable, which makes generalization impossible. In more recent work, Homer-Dixon and associates acknowledge that they cannot say anything about causal effects, but argue that biased case selection aids in identifying causal mechanisms (Schwartz, Deligiannis and Homer-Dixon, 2001).

A few studies have attempted a more systematic examination of the links between environmental scarcity and internal violent conflict.[9] Hauge and Ellingsen (1998) tested the effect of deforestation, land degradation, and scarcity of freshwater on internal conflict in the period 1980–92, controlling for standard factors in the study of civil war. They found a modest, but significant effect of the scarcity variables. The US State Failure Task Force, on the other hand, failed to find a significant relationship between environmental deterioration and 'state failure' (Esty et al. 1998). King and Zeng (2001) pointed out several methodological problems in the Task Force's analysis and proposed improved procedures, but their article does not report new results for the environmental variables. De Soysa (2002: 10–11) pointed

[9] In this brief survey, we ignore studies of scarcity and interstate conflict, which are less relevant to our empirical test below.

out that Hauge and Ellingsen's operationalization of two of the environmental variables did not really capture scarcity. Rates of deforestation and soil degradation, for which they get the strongest results, do not measure environmental pressure. A high rate of change of forest area or cropland without accounting for available stock may simply signify that a country vulnerable exploits an abundant resource. Leach and Fairhead (2000) have also challenged the neomalthusian link between population growth and deforestation in West Africa, but without spelling out the consequences for scarcity conflict.

The link between environmental pressure and conflict is mediated in part by the ability of societies to achieve such collective goods as economic growth and innovation, thereby adapting to changing conditions generated by resource scarcity. To deal with scarcity, a society needs ingenuity – but the very scarcities demanding social ingenuity act as constraints on innovation. As they claim, over time, an 'ingenuity gap' develops because society is unable to deal with environmental scarcity, leading ultimately to social disarray and conflict. Contrary to a large body of literature on the causes of economic growth that finds natural resource wealth to be problematic for growth and governance (Lal and Myint, 1996; Ross, 1999; Sachs and Warner, 2001), ecoviolence theorists argue that scarcity is a barrier against the production of ingenuity and adaptation to economic hardship. Our approach to this question treats the environment more broadly with measures that capture aspects of availability relative to all forms of human demands on the ecology. In other words, the measures we use capture aspects above and beyond the effects of narrowly defined natural resources to encompass bio-capacity and current consumption of environmental services.

In opposition to the ecoviolence perspective on conflict, some see natural wealth directly fuelling economic failure, corruption, and conflict (Auty, 2001; de Soysa, 2005; Ross, 1999, 2004a, b). In research on civil war at the World Bank, natural resource capture features as a direct motive for organizing large-scale rebellion as well as providing the finance for sustaining it. These studies find strong empirical support for the proposition that natural resources motivate rapacious behavior and allow the finance of civil war (Collier et al., 2003). Holding other salient variables constant, the share of primary exports in total exports exhibits the strongest effect on the incidence of civil war.

Many of today's most durable conflicts, such as Angola, Liberia, the Democratic Republic of Congo, Sierra Leone, etc are fueled by the struggle for control of oil, diamonds, timber, and other resources, and various conflicts in Asia and Latin America are funded by profits from trade in illegal commodities, such as drugs, or hardwood timber, and other forms of contraband. Since large-scale violence requires finance the poor, who are the most likely victims of climate-related ecological changes, are less likely to organize sophisticated movements that take on the power of state forces. The recent findings seem also to have influenced some proponents of ecoviolence arguments. A recent Worldwatch Institute publication (WWI, 2003), while featuring environmental scarcity as an important factor in conflict, also emphasizes that abundant natural resources, such as oil, minerals, metals, diamonds and other gem stones, drug crops, and timber, have helped fuel a large number of conflicts in developing countries.

Others, while corroborating the World Bank's main theoretical reasoning showing opportunity (or greed) to be a greater reason for why there is civil war as opposed to injustice and other grievances, have been unable to replicate the World Bank's results when controlling for oil dependence (Fearon, 2005). According to Fearon and Laitin (2003), countries that derive at least 1/3 of their exports from oil double their risk of conflict. In contrast to the Collier-Hoeffler model of looting rebels, they propose that the mechanism is likely to be state weakness in oil-extracting countries. Resource-wealthy states are institutionally weak because resources, and not people, become the primary tax base.

While there will be considerable debate into the future as to whether the exact mechanism from natural resources to conflict works through looting or state capacity, there is little evidence in the theoretical and large-N empirical literature suggesting a direct link from resource scarcity to conflict. There is more evidence to suggest that large rents from natural resources hamper state capacity and socio-economic progress, factors directly linked to conflict. However, with a few exceptions such as Lujala et al. (2005), the literature on resource abundance and conflict suffers from some of the same problems as the resource scarcity literature, in that it relies heavily on biased case selection.

Questions of collapse and conflict need to address broader issues of sustainability than the scarcity or abundance of individual natural resources. In order to test a more general argument about the effects of environmental pressure on conflict, we look at the relationship between internal armed conflict using two different indicators of environmental sustainability: the Ecological Footprint and the World Bank's Adjusted Net Savings. We discuss these measures in greater detail below

Methods and data

To investigate the relationship between environmental pressure and internal armed conflict, we rely on a pooled, time-series cross-sectional dataset. We use the replication data from Fearon and Laitin (2003). In addition to their high threshold of 1,000 battle deaths, we also analyze smaller conflicts with an annual 25 deaths threshold in the Uppsala-PRIO dataset (Gleditsch et al., 2002).

There is a wide range of literature on the concept of environmental sustainability, and a wide range of different tools to measure the concept. However, measures for large numbers of countries covering a lengthy period of time are harder to find. We found the following two indicators most interesting: the *Ecological Footprint* (Wackernagel and Rees, 1996), which covers the time-period 1961–2001 and is a measure of strong sustainability,[10]

[10] Strong sustainability is the notion that there is no substitutability between forms of capital. In other words, nature should be kept intact for future generations. Weak sustainability is the notion that

and the World Bank's *Adjusted Net Savings* (genuine savings), which covers the 1970–2001 period and is a measure of weak sustainability.

Ecological Footprint

The Ecological footprint (EF) is computed by Mathis Wackernagel and his associates and covers 150 countries from 1961 to 2001.[11] The purpose of the indicator is to 'measure (...) how much biologically productive land and water area an individual, a city, a country, a region, or humanity requires to produce the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management schemes' (WWF 2004: 34). The EF consists of six main bioproductive areas: cropland, grazing land, forest area, fishing ground, built-up land and 'energy land'. To enable comparison cross time and space, the areas are transformed into a standardized unit, or 'global hectare.' The three main variables are: the ecological supply (bio-capacity), the demand on nature (ecological footprint), and the difference between the two – the ecological reserve or deficit.

The footprint represents consumption, rather than production. Thus, the footprint of a given product is added to the consumer country and not the producer country. The footprint is therefore calculated as follows: *Consumption footprint = production footprint + imports – exports*. The domestic production is further adjusted for production waste (WWF 2004: 35). Although the Ecological Footprint is popular among environmentalists, it has also been criticized (Neumayer, 2004). One of the main objections is the footprint's dependency on fossil energy consumption. Fifty per cent of the total footprint stems from CO_2 emissions, and most of the increase in footprints since 1961 is due to an increase in CO_2 emissions (Ayres, 2000; EAI, 2002; van den Bergh and Verbruggen, 1999). To convert fossil fuel use to land area and 'global hectares', the measurement is based on the land area of forest necessary to sequester atmospheric CO_2 (minus 1/3 which is absorbed by oceans). Nuclear energy use is included in the energy consumption measure as if it was fossil fuel (Wackernagel et al., 2004a).

Wackernagel and his associates argue that this is the best available solution. Critics argue that there are other ways to reduce CO_2 concentration, for instance to lower emissions through '... increasing energy efficiency, by turning to less carbon intense forms of energy, or by turning to energy sources with close to zero emissions, such as nuclear or renewable energy.' (EAI 2002: 19). Wackernagel (1999: 317) replies that the CO_2 emissions are already there. Although there are innovative future technological ways to reduce the CO_2 concentrations, the footprint is a measure of the demand on nature today – not how it can be

natural capital can be substituted by human and physical capital. In other words, knowledge and technology can substitute for ecoservices (Neumayer, 2003).

[11] See Monfreda, Wackernagel, and Deumling (2004), Wackernagel (1999), Wackernagel and Rees (1996), and Wackernagel et al. (1999, 2004a,b). For an explication with some critical remarks, see Ferguson (2002).

reduced in the future. The Environmental Assessment Institute in Copenhagen also criticizes the footprint for not taking into account any economic or social factors (EAI 2002: 15). van den Bergh and Verbruggen (1999: 63) argue that the Footprint does not consider regional and local differences in land use and land types, neither does it distinguish between sustainable and unsustainable land use. Further, van den Bergh and Verbruggen (1999) and Ayres (2000) argue that the EF has an anti-trade bias. The implication that no country should have an ecological deficit suggests that trade is ecologically unfriendly. The EF does not take comparative advantages into account, but 'National boundaries are of a geo-political and cultural nature and have no environmental meaning' (van den Bergh and Verbruggen 1999: 66).

Despite such criticisms of the EF, it is an ambitious undertaking and one of the more widely cited environmental indicators developed for the explicit purpose of tracking the overall environmental health of the planet. According to Dauvergne (2005: 17), the EF is 'one of the most innovative ways scholars have tried to compare the ecological impacts of individuals across the globe.' The EF has been embraced not just by the World Wide Fund for Nature (also known as the World Wildlife Fund) but also by the United Nations Environment Program (see WWF, 2004). In our analyses we use all three main variables; *biocapacity per capita*, *ecological footprint per capita,* and *ecological reserve per capita*. All variables are ln-transformed. To avoid losing the lower end of the scale, the ecological reserve was adjusted so as to contain only positive values.

Adjusted Net Savings

Adjusted Net Savings, or Genuine Savings (GS) is a measure created by the World Bank, covering 149 countries from 1970 to 2001 (Hamilton et al., 2000; Kunte et al., 1998). It is expressed in current US$ and is made up of aggregating all the known resources valuable to man based on international prices. The GS is a measure of how well a country manages its total assets, which include physical, human, and natural resources. Traditional accounts treat education expenditure as consumption. The GS adds education expenditure back as a saving because investing in education enhances economic sustainability. However, while traditional growth accounting looks at the growth of physical capital, GS discounts environmental harm in terms of CO_2 pollution (costed at $20 per kilogram) and the depleting of natural resources from the capital stock (see Kunte et al. 1998 for details of calculation). The Genuine Savings is computed as follows: *Genuine Saving = Net Saving + Current Education Expenditure – Resource Rents (Depletion of Energy, Minerals and Forest) –* CO_2 *Damage.*

Because of the way the GS is computed, Neumayer (2004: 145) argues that 'GS is at best a one-sided indicator of sustainability: negative GS rates signal unsustainability, but positive GS rates cannot be interpreted as an indication that weak sustainability (WS) has been achieved.' Another worrisome aspect of the GS is that it does not take into consideration some of the main challenges which face the global environment today.[12] First, forests are the only renewable resource mentioned. The other natural resources that constitute the 'natural resource rents' of the equation are non-renewable fossil fuels and minerals. However, whether countries manage their fisheries, soils, and water resources are of great importance for the ecological welfare of the country. Second, only CO_2 emissions are included as (air) pollution, but a substantial amount of other pollutants make more immediate contributions to an unhealthy environment.[13] Third, the GS does not cover population growth, or include population numbers in the equation. Fourth, the only measure of human capital that is considered is education expenditure. Although this is a valuable additive relative to traditional national accounts, a country's human capital is more diverse than education. Finally, the GS completely excludes social capital, which also is an important part of countries' wellbeing. In general, GS is a measure of how governments are investing in future sustainability and possibly captures other aspects of governance including economic efficiency. The GS variable we use in our analyses is ln-transformed *genuine savings per capita*.[14] The original genuine savings variable was also adjusted to contain only positive values before ln-transformation.

Other Indices

In addition to the time-series data for EF and GS, we also investigated two other cross-sectional indices measured only for a single time-point: the *Environmental Sustainability Index* and the *Ecosystem Wellbeing Index*. The Environmental Sustainability Index is created by the Environmental Performance Measurement Project at Yale University, the Center for International Earth Science Information Network (CIESIN) at Columbia University, and the World Economic Forum. The recent version (2005) of ESI covers 146 countries and provides one observation for each country, with various source years. It has five components made up of 21 indicators, which are made up of 76 variables. The five components are: environmental systems, reducing environmental stresses, reducing human vulnerability, social and institutional capacity, and global stewardship (Esty et al. 2005).[15]

The Ecosystem Wellbeing Index (Prescott-Allen 2001) focuses explicitly on ecological stress. The EWI covers 181 countries and consists of 5 components made up of 51 indicators. The five components that make up the index are: land, water, air, species and genes, and

[12] We rely to a large extent on Dietz and Neumayer (2004) and Neumayer (2004) for this discussion.
[13] The World Bank is in the process of including other air and water pollutants in their calculations.
[14] Population data are from the EF dataset.
[15] See Esty et al. (2005) for more information and an overview of the variables included in the ESI. See e.g. Morse and Fraser (2005) for criticism.

resource use, the information of the 51 indicators are aggregated into one score. The indicators are measured at different points in time within our testing period (1989–99).[16]

Because of the lack of time-series data for the ESI and the EWI we could not run the same time-series cross-sectional models as we did for the EF variables and the GS. In order to examine the interrelationship between the five sustainability indicators, we ran a factor analysis with the three time-series indicators and the ESI and EWI. The results are not reported here in table form. To obtain a clearer view of the relationships between the indicators, we conducted the analysis with data from 1989–99, with values for ESI and EWI copied for each year for the relevant country. The analysis shows two clear factors, a 'development' dimension, with high loadings for GS, ESI and EF, and an 'environmental' dimension with high loadings for EWI and ecological reserve.[17] Neither factor is statistically significant when included as an independent variable in a regression with conflict as the dependent variable, with the exception that the development factor is negatively and significantly related to conflict using the Uppsala-PRIO data and when per capita income is dropped from the model. The environmental factor does not predict the onset of conflict to any significant degree. In the following analyses, we use only the ecological indicators measured at multiple time-points.

Control variables

For maximum comparability and replicability we use the models and data in Fearon and Laitin (2003), the most-frequently cited recent article on civil war. We use their Model 1 as our basic model.[18] This strategy is followed by several recent studies on civil war (Barbieri and Reuveny, 2005; Lujala, Gleditsch and Gilmore, 2005). Our dependent variables are civil war at two different intensities. The high-intensity variable requires a minimum of 1,000 battle deaths, as recorded in the Fearon and Laitin (FL) data as well as in the closely related Correlates of War (CoW) data. For the lower-intensity conflicts we use the Uppsala-PRIO armed conflict data (Gleditsch et al., 2002), with a minimum of 25 casualties in a year. To control for time dependency, Fearon and Laitin (2003) use a dummy variable, *prior war*, which has the value 1 if there was a civil war ongoing in the country the previous year. Based on the same logic we computed a dummy variable for *prior war* with the Uppsala-PRIO data.

Income per capita (in US$ 1,000) is lagged one year and ln-transformed to reduce skewness. Income is taken from the Penn World Tables 5.6 and World Bank data. In

---

[16] See Prescott-Allen (2001) for more information on the EWI and an overview of the 51 indicators included.

[17] The variables in the 'development' dimension were also highly correlated with GDP per capita. See Correlation Matrix in Appendix 2.

[18] The only difference is that we ln-transform income per capita instead of the non-transformed income variable used by Fearon and Laitin (2003).

addition, Fearon and Laitin (2003) use energy consumption per capita from the CoW project to estimate missing values. Their *population* variable is based mainly on data from the World Bank. It is expressed in 1,000s, lagged one year and ln-transformed. Fearon and Laitin (2003) use a variable which measures the *percentage of mountainous terrain* as a proxy for rough terrain, arguing that such terrain located far away from the government increases the likelihood of insurgency. A control variable for *noncontiguous state* is a dummy with the value 1 if a country has a territory with at least 10,000 inhabitants separated by at least 100 km of sea or land from the territory which contains the capital city. Fearon and Laitin (2003) also include a dummy variable which expresses whether a country's fuel exports exceeded one-third of export revenues in a given year. The data for the *oil exporter* variable is from the World Bank. To take into account the greater probability of rebellion occurring in newly independent states, Fearon and Laitin (2003) include a dummy variable, *new state*, with a positive value for the first and second years of independence. They also find that political *instability* increases the risk of civil war and use a dummy variable, which gauges a 3-point or larger change in the Polity index within the three previous years. The *democracy* variable is from the Polity IV project, using the difference between the democracy and autocracy scales. Fearon and Laitin (2003) interpolate values for 'transition periods', set 'foreign occupation' to missing and treat 'interruptions' as zeros. The variable is lagged one year. Finally, the model includes *ethnic fractionalization* and *religious fractionalization*. Detailed descriptions of all data are found in Fearon and Laitin (2003).

Results

Table 1 reports results of each of our longitudinal measures of environmental pressure. In column 1, we replicate the basic Fearon and Laitin model. Our results are comparable with theirs. In column 2, we enter the ecological footprint. Its effect is negatively related to the onset of conflict, a result that is highly significant. Moreover, the highly significant negative effect of income is no longer significant. Higher consumption of earth's resources per capita relative to the ability to sustain it is associated with peace. This result is also substantively quite large.[19] Holding all other variables at their mean values and raising EF by one standard deviation above the mean reduces the global average risk of conflict by 57 percent (see Appendix 3 for summary statistics). The bivariate correlation between EF and GDP/cap is 0.81, so it is not altogether surprising that one of them reduces the effect of the other.

Column 3 shows that bio-capacity is also negatively related to conflict. The higher the bio-capacity per capita, the better the chance of peace, a result that ostensibly supports neo-malthusian assertions. However, the substantive effect of this variable is roughly half the impact of EF (higher consumption per capita). Holding all other variables at their mean values, raising bio-capacity per capita by one standard deviation above the mean reduces the

---

[19] We use the program Clarify to compute substantive effects (Tomz, Wittenberg, and King 2003).

mean risk of conflict by 31 percent. In column 4, we test the ecological reserve, which is bio-capacity minus the EF. If a society's EF is really high relative to its capacity, then the reserve should be smaller. This variable is not statistically significant. Testing capacity relative to footprint, however, is not without problems given that the EF may capture aspects of environmental expropriation (through trade) while capacity refers to a country's available ecological assets.[20]

In column 5, we test the effect of Genuine Savings on conflict. GS is also negatively related to conflict, but its substantive effects are weaker. Holding the other variables at their mean values, raising GS one standard deviation above the mean reduces the average risk of an onset only by 19 percent. Perhaps the negative effect of GS signifies that governance matters, since GS is determined by savings in general and investment in education while it also penalizes extraction of resources.

Table 2 reports the same results but with the Uppsala-PRIO data that defines conflict at the lower battle death threshold of 25 deaths and above. We obtain identical results to those with the civil war onsets with more than 1,000 deaths. The substantive results also array pretty much the same way as with our previous results, with the EF having the largest reduction of the average risk of an onset of conflict when raised by one standard deviation above the mean (holding the controls at their mean values) (43%), bio-capacity next (20%), and GS with the lowest peace effect (18%). When testing GS, the oil exporter dummy loses statistical significance. This suggests that GS may capture some of the effects of oil on conflict, since high oil exporters tend to have very low GS (de Soysa and Neumayer, 2005). Again, the most relevant ecological pressure variable, the ecological reserve is statistically not significant.

We also tested our ecological variables on the CoW civil war data, but do not report these results in table form. The findings are almost the same as those obtained with the two other civil war datasets. In this case, however, the ecological reserve variable is negative and statistically highly significant. The substantive effect of the ecological reserve result, however, is almost three-and-a-half times smaller for reducing the average risk of conflict onset compared with the EF.[21] The other variables also show much lower substantive effects on the reduction of the risk of conflict onset compared with the EF, when using the CoW data. In Table 4, we investigate the ecological reserve in greater detail. The statistically significant linear effect is rather fragile. For example, running the model for CoW civil wars

---

[20] In sensitivity analyses, we ran the model with trade, export, and import dependence. Neither of these variables was significant, nor did it alter the basic results for EF. Thus, the relationship between EF and conflict is not sensitive to the inclusion of trade. The result for bio-capacity, however, is sensitive to sample size and the inclusion of trade (results not shown).

[21] Again, we hold all other variables at their mean values and raise the variable of interest by a standard deviation above the mean.

without Kuwait, an outlier when predicting the ecological reserve with income, reduces statistical significance from 1% level to 10% level (results not shown).[22]

Nevertheless, as seen in Table 3, the ecological reserve shows a strong curvilinear effect, where the risk of conflict rises with increasing reserve and eventually drops off. This result is only true for civil wars above 1,000 deaths. Neither the linear, nor the curvilinear, effect is statistically significant using the Uppsala-PRIO data. On further examination, we find that the linear term and the curvilinear terms of the ecological reserve become statistically not significant when testing only the post-Cold War years (results not shown).[23] If the EF is strongly negative on conflict and availability indicators are fragile, particularly for the recent decades, then we must reject the notion that Malthusian arguments have much credence. Why would the reserve show the weakest results for the most recent decades when our domination of the planet is at very high levels? On the other hand, the best environmental pressure variables may be inadequate for telling us much about whether environmental factors are good predictors of conflict at all. It is impossible for us, however, simultaneously to evaluate theories and the validity of the measures.

As mentioned above, we ran several sensitivity tests on the basic results. For example, we included measures of trade, imports, and exports of GDP independently in the basic models. Since the EF in particular takes the expropriation of ecological services through trade into account, we wanted to check the sensitivity of this result to the inclusion of trade variables. While the results on bio-capacity per capita and the ecological reserve per capita seemed to be quite sensitive to the inclusion of trade variables and the changes in sample size, the ecological footprint was robustly negatively related to the onset of conflict. We also ran the models only for a sub-sample of developing countries since the rich countries that have high EF might be influencing the results. The results on EF remain the same. To minimize the effect of simultaneity, we ran the EF models with EF lagged by one year, but the results were exactly the same. These additional tests allow us some confidence in the basic findings and conclusions reported here.

Conclusion

Scholars have engaged in a long and polarized debate about the social effects of global ecological decay. Neomalthusians have argued that global environmental change leads to scarcities of resources that could lead to societal collapse. Somalia, Rwanda, and Haiti serve as poster children for such arguments. Others have suggested that natural resource

---

[22] We tested our ecological variables, including the Environmental Sustainability Index and the Ecosystem Wellbeing Index, for only the post-Cold War period. None of the effects were significant except of footprint per capita, which continues to be negative and significant with the Fearon and Laitin onset of civil war.

[23] In fact, it sometimes turns positive and statistically significant when the CoW and FL civil war data are used testing the post-Cold War years.

abundance, rather than scarcity, fuels conflict and socio-economic stagnation – such places as the DRC, Sierra Leone, Nigeria, Angola, Algeria, and Colombia are prominent examples. We have tested broader measures of ecological pressure that capture all dimensions of human activity and the earth's relative capacity for supporting them. These broader measures of ecological sustainability say more about the environmental conditions of states than do mere natural resources.

Our results are easily summed up: There is little if any evidence for a connection between the neo-malthusian factors captured by these indicators of sustainability and the onset of civil conflict. On the contrary, our strongest result is that the ecological footprint, perhaps the most widely accepted measure of man's use (or abuse) of ecoservices, is *positively* correlated with peace, a result that is stubborn and substantively large. Some of our results, albeit fragile, do suggest that higher levels of bio-capacity and ecological reserve may predict peace. If reliable, these findings pose a cruel dilemma: The only way the poor might reduce their risk of conflict is to lower their footprints. Increasing bio-capacity is a non-option short of annexing land, or massive reductions of resource-dependent populations (mass death). Clearly, wealth and increased footprints predict peace. But since the poorest already have the lowest footprints, lowering consumption to ease pressures from a low reserve is not on the agenda.

Our test of some of the most promising broadly-based indicators of ecological pressure allows only limited policy-relevant conclusions. Continued wealth creation and the eradication of consumption scarcity among the poor will make them less dependent on mother nature's gifts. This seems likely to promote peace (Collier and Hoeffler, 2005). On this score, the rich could do a lot more to change the rules that govern global policies on trade, investment, and other mechanisms that would allow the poor to expropriate some of the consumption possibilities of the already rich. Future research should probe the exact mechanisms that link higher footprints with peace, such as governance, economic modernization, and production and consumption structures.

References

Auty, Richard M., ed., 2001. *Resource Abundance and Economic Development*. Oxford: Oxford University Press.

Ayres, Robert U., 2000. 'Commentary on the Utility of the Ecological Footprint Concept', *Ecological Economics* 32(3): 347–349.

Barbieri, Katherine, and Rafael Reuveny. 2005. Economic Globalization and Civil War, *Journal of Politics* 67(4): 1228–47.

Boserup, Ester, 1965. *The Conditions of Agricultural Growth; the Economics of Agrarian Change under Population Pressure.* London: Allan and Unwin.

Brauch, Hans Günter, ed., 2003. *Security and the Environment in the Mediterranean: Conceptualising Security and Environmental Conflicts*. Berlin: Springer.

Cassils, J. Anthony, 2004. 'Overpopulation, Sustainable Development, and Security: Developing an Integrated Strategy', *Population and Environment* 25(3): 171–194.

Collier, Paul, Lani Elliot, Håvard Hegre, Anke Hoeffler, Marta Reynal-Querol, and Nicholas Sambanis. 2003. *Breaking the Conflict Trap: Civil War and Development Policy*. Oxford: Oxford University Press. Electronic version available on www.worldbank.org.

Collier, Paul and Anke Hoeffler, 2005. 'Resource Rents, Governance, and Conflict', *Journal of Conflict Resolution* 49(4): 625–633.

Dauvergne, Peter, ed., 2005. *Handbook of Global Environmental Politics*. Cheltenham: Edward Elgar.

de Soysa, Indra, 2002. 'Ecoviolence: Shrinking Pie or Honey Pot?', *Global Environmental Politics* 2(4): 1–27.

de Soysa, Indra, 2005. 'Filthy Rich, Not Dirt Poor! How Nature Nurtures Civil Violence', in Peter Dauvergne, ed., *Handbook of Global Environmental Politics*. Cheltenham: Edward Elgar (149–169).

de Soysa, Indra and Eric Neumayer, 2005. 'False Prophet, or Genuine Savior? Assessing the Effects of Economic Openness on Sustainable Development, 1980–1999', *International Organization* 59(3): 731–772.

Diamond, Jared, 2005. Collapse: How Societies Choose to Fail or Survive. London: Penguin.

Dietz, Simon and Eric Neumayer, 2004. Genuine Savings: A Critical Analysis of its Policy-Guiding Value, *International Journal of Environment and Sustainable Development* 3(3/4): 276–292.

Dryzek, John S., 1987. Rational Ecology. Environment and Political Economy. Oxford: Blackwell.

EAI, 2002. *Assessing the Ecological Footprint. A Look at the WWF's Living Planet Report 2002,* www.imv.dk/Files/Filer/Rapporter/Verdens%20og%20Europas%20tilstand/ecological_footprint.pdf.

Esty, Daniel C. et al., 1998. *State Failure Task Force Report: Phase II Findings.* McLean, VA: Science Applications International, for State Failure Task Force.

Esty, Daniel C., Mark Levy, Tanja Srebotnjak, and Alexander de Sherbinin. 2005. *Environmental Sustainability Index: Benchmarking National Environmental Stewardship* Yale Center for Environmental Law and Policy, www.yale.edu/esi/ESI2005.pdf.

Fearon, James D., 2005. ‘Primary Commodities Exports and Civil War’, *Journal of Conflict Resolution* 49(4): 483–507.

Fearon, James D. and David D. Laitin, 2003. ‘Ethnicity, Insurgency, and Civil War’, *American Political Science Review* 97(1): 1–16.

Ferguson, Andrew R.B., 2002. 'The Assumptions Underlysing Eco-Footprinting', *Population and Environment* 23(3): 303–313.

Gleditsch, Nils Petter, 1998. ‘Armed Conflict and the Environment: A Critique of the Literature’, *Journal of Peace Research* 35(3): 381–400.

Gleditsch, Nils Petter, 2003. ‘Environmental Conflict: Neomalthusians vs. Cornucopians’, in Hans Günter Brauch, ed., *Security and the Environment in the Mediterranean: Conceptualising Security and Environmental Conflicts*. Berlin: Springer (477–485).

Gleditsch. Nils Petter & Henrik Urdal, 2004. ‘Roots of Conflict: Don’t Blame Environmental Decay for the Next War’, International Herald Tribune (op-ed), 22 November: 10, www.iht.com/articles/2004/11/21/opinion/ednils.html.

Gleditsch, Nils Petter; Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand, 2002. ‘Armed Conflict 1946–2001: A New Dataset’, *Journal of Peace Research* 39(5): 615–637.

Hamilton, Kirk; Giles Atkinson & David Pearce, 2000. *Genuine Savings as a Sustainability Indicator.* Working Paper GEC 97-03. London: Centre for Social and Economic Research on the Global Environment, University College London & University of East Anglia, www.uea.ac.uk/env/cserge/pub/wp/gec/gec_1997_03.pdf.

Hauge, Wenche and Tanja Ellingsen. 1998. 'Beyond Environmental Scarcity: Causal Pathways to Conflict', *Journal of Peace Research* 35(3): 299–317.

Homer-Dixon, Thomas F., 1999. *Environment, Scarcity, and Violence*. Princeton, NJ: Princeton University Press.

Homer-Dixon, Thomas F., 2000. *The Ingenuity Gap*. New York: Knopf.

King, Gary and Lanche Zeng, 2001. 'Improving Forecasts of State Failure', *World Politics* 53(4): 623–658.

Kunte, Arundhati; Kirk Hamilton; John Dixon and Michael Clemens, 1998. *Estimating National Wealth: Methodology and Results.* http://wbln0018.worldbank.org/environment/EEI.nsf/0/0625cac87abee1948525671d00505b51/$FILE/Kunte.pdf.

Lal, Deepak and Hla Myint, 1996. *The Political Economy of Poverty, Equity, and Growth*. Oxford: Clarendon.

Leach, Melissa and James Fairhead, 2000. ‘Challenging Neo-Malthusian Deforestation Analyses in West Africa’s Dynamic Forest Landscapes’, *Population and Development Review* 26(1): 17–43.

Lomborg, Bjørn, 2001. The Skeptical Environmentalist: Measuring the Real State of the World. Cambridge: Cambridge University Press.

Lujala, Päivi; Nils Petter Gleditsch, and Elisabeth Gilmore, 2005. ‘A Diamond Curse: Civil War and Lootable Resources’, *Journal of Conflict Resolution* 49(4): 538–562.

MEA, 2003. *Ecosystems and Human Well-Being: A Framework for Assessment*. Washington, DC: Island Press, for Millennium Ecosystem Assessment.

Meadows, Donella H.; Dennis L. Meadows, Jørgen Randers & William W. Behrens III, 1972. *The Limits to Growth : A Report for the Club of Rome's Project on the Predicament of Mankind.* London & New York: Earth Island & Universe Books.

Meadows, Donella H.; Jørgen Randers, and Dennis Meadows, 2004. *Limits to Growth: The 30-year Update.* White River Junction, VT: Chelsea Green.

Monfreda, Chad; Mathis Wackernagel and Diana Deumling, 2004. 'Establishing National Natural Capital Accounts based on Detailed Ecological Footprint and Biological Capacity Assessments', *Land Use Policy* 21(3): 231–246.

Morse, Stephen and Evan D. G. Fraser. 2005. 'Making Dirty Nations Look Clean? The Nation State and the Problem of Selecting and Weighting Indices as Tools for Measuring Progress Towards Sustainability', *Geoforum* 36(5): 625–640.

Neumayer, Eric. 2003. Weak versus Strong Sustainability: Exploring the Limits of Two Opposing Paradigms. Cheltenham & Northampton, MA: Edward Elgar.

Neumayer, Eric, 2004. 'Indicators of Sustainability', in Tom Tietenberg and Henk Folmer, eds, *International Yearbook of Environmental and Resource Economics*. Cheltenham: Edward Elgar (139–188).

Nordås, Ragnhild and Nils Petter Gleditsch, 2005. *Climate Conflict: Common Sense or Nonsense?* Paper presented at the Human Security and Climate Change. Asker, Norway, 21–23 June, www.cicero.uio.no/humsec.

Page, Edward and M. R. Redclift, 2002. *Human Security and the Environment: International Comparisons*. Northhampton, MA: Edward Elgar.

Panyarachun, Anand, 2004. *A More Secure World: Our Shared Responsibility.* Report on the Secretary-General's High-level Panel on Threats, Challenges and Change. New York: United Nations, www.un.org/secureworld/.

Peluso, Nancy Lee and Michael Watts, 2001. 'Violent Environments', in Nancy Lee Peluso and Michael Watts, eds, *Violent Environments*. London: Cornell University Press (3–38).

Prescott-Allen, Robert. 2001. *The Wellbeing of Nations. A Country by Country Index of Quality of Life and the Environment*. Washington, DC: Island Press, for International Development Research Council.

Renner, Michael, 1996. Fighting for Survival: Environmental Decline, Social Conflict, and the New Age of Insecurity. London: Norton.

Ross, Michael, 1999. 'The Political Economy of the Resource Curse', *World Politics* 51(2): 297–332.

Ross, Michael, 2004a. 'How Do Natural Resources Influence Civil War? Evidence from Case Studies', *International Organization* 58(2): 35–67.

Ross, Michael, 2004b. 'What Do We Know about Natural Resources and Civil War?', *Journal of Peace Research* 41(3): 337–356.

Sachs, Jeffrey D. and Andrew Warner, 2001. 'The Curse of Natural Resources', *European Economic Review* 45(4–6): 827–838.

Schwartz, Daniel M.; Tom Deligiannis and Thomas F. Homer-Dixon, 2001. 'The Environment and Violent Conflict', in Paul F. Diehl and Nils Petter Gleditsch, eds, *Environmental Conflict*. Boulder, CO: Westview (273–294).

Schwartz, Peter & Doug Randall, 2003. An Abrupt Climate Change Scenario and Its Implications for United States National Security. Washington, DC: Environmental Media Services, www.ems.org/climate/pentagon_climate_change.html.

Simon, Julian L., 1998. *The Ultimate Resource II*. Princeton, NJ: Princeton University Press.

Smil, Vaclav, 2005. 'Limits to Growth Revisited: A Review Essay', *Population and Development Review* 31(1): 157-164.

Tomz, Michael, Jason Wittenberg, and Gary King. 2003. Clarify: Software for Interpreting and Presenting Statistical Results. Cambridge, MA: Harvard University, http://gking.harvard.edu/clarify/docs/clarify.html.

van den Bergh, Jeroen C. J. M. and Harmen Verbruggen, 1999. 'Spatial Sustainability, Trade and Indicators: an Evaluation of the 'Ecological Footprint'', *Ecological Economics* 29(1): 61–72.

Vitousek, Peter M.; Harold A. Mooney; Jane Lubchenko and Jerry A. Melilo, 1997. 'Human Domination of Earth's Ecosystems', *Science* 277(5335): 494–499.

Wackernagel, Mathis and William E. Rees, 1996. *Our Ecological Footprint: Reducing Human Impact on the Earth*. Gabriola Island, Canada: New Society Publishers.

Wackernagel, Mathis, 1999. 'An Evaluation of the Ecological Footprint', *Ecological Economics* 31(3): 317–318.

Wackernagel, Mathis, Larry Onisto, Patricia Bello, Alejandro Cllejas Linares, Ina Susana López Falfán, Jesus Méndez Garciá, Ana Isabel Suárez Guerrero, and Ma. Guadaloupe Suárez Guerrero, 1999. 'National Natural Capital Accounting with the Ecological Footprint Concept', *Ecological Economics* 29(3): 375–390.

Wackernagel, Mathis, Chad Monfreda, Dan Moran, Steve Goldfinger, Diana Deumling, and Michael Murray, 2004a. *National Footprint and Biocapacity Accounts 2004: The Underlying Calculation Method*, downloaded 29 July 2005 from www.footprintnetwork.org/download.php?id=5.

Wackernagel, Mathis, Chad Monfreda, Niels B. Schultz, Karl-Heinz Erb, Helmut Haberl, and Fridolin Krausmann, 2004b. 'Calculating National and Global Ecological Footprint Time Series: Resolving Conceptual Challenges', *Land Use Policy* 21(3): 271–278.

WWF, 2004. *Living Planet Report.* Gland, Switzerland: WWF – World Wide Fund for Nature, in association with UNEP and Global Footprint Network, http://worldwildlife.org/about/lpr2004.pdf.

WWI, 2003. *Vital Signs 2003: The Trends that Are Shaping Our Future*. London: Norton, for World Watch Institute.

Appendix 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FL onset	4,651	0.017	0.129	0	1
UP onset	4,651	0.035	0.183	0	1
CoW onset	3,762	0.015	0.123	0	1
Footprint per capita (ln)	4,651	0.567	0.667	-3.665	2.545
Bio-capacity per capita (ln)	4,651	0.825	1.034	-5.611	3.978
Ecological reserve per capita (ln)	4,651	2.574	0.337	-5.994	4.154
Genuine Savings per capita (ln)	2,164	9.700	0.087	7.330	10.069
Environmental Sustainability Index	147	49.906	8.391	29.200	75.100
Ecosystem Wellbeing Index	152	43.474	13.395	16	72
Per capita income[a, b] (ln)	4,651	7.730	1.033	5.279	10.895
Population[a, b] (ln)	4,651	9.172	1.427	5.541	14.029
Mountainous terrain[a] (ln)	4,651	2.128	1.401	0	4.421
Noncontiguous state	4,651	0.170	0.376	0	1
Oil exporter	4,651	0.137	0.344	0	1
New state	4,651	0.017	0.128	0	1
Instability[a]	4,651	0.146	0.353	0	1
Democracy[a,]	4,651	-0.349	7.590	-10	10
Ethnic fractionalization	4,651	0.403	0.293	0.001	0.925
Religious fractionalization	4,651	0.370	0.222	0	0.783

[a] Lagged one year

[b] In 1,000s.

Appendix 2: Correlation Matrix

	FL onset	Uppsala-PRIO onset	Per capita income[a,b] (ln)	Footprint per capita (ln)	Bio-capacity per capita (ln)	Ecological reserve per capita (ln)	Genuine savings per capita (ln)	Environmental Sustainability Index	Ecosystem Wellbeing Index
FL onset	1.000								
Uppsala-PRIO onset	0.240	1.000							
Per capita income[a,b] (ln)	-0.086	-0.085	1.000						
Footprint per capita (ln)	-0.103	-0.108	0.883	1.000					
Bio-capacity per capita (ln)	-0.066	-0.092	0.295	0.443	1.000				
Ecological reserve per capita (ln)	-0.009	-0.031	-0.129	-0.085	0.759	1.000			
Genuine savings per capita (ln)	-0.006	-0.013	0.058	0.072	0.080	0.018	1.000		
Environmental Sustainability Index	-0.087	-0.104	0.464	0.534	0.701	0.456	0.136	1.000	
Ecosystem Wellbeing Index	0.037	0.0003	-0.601	-0.513	0.148	0.370	0.0002	0.066	1.000

2124 observations (1970–99)

[a] Lagged one year

[b] In 1,000s

Table 1 Logit analyses of Ecological Footprint and Genuine Savings on onset of Fearon and Laitin (2003) civil war

	(1) FL onset 1945–99	(2) FL onset 1961–99	(3) FL onset 1961–99	(4) FL onset 1961–99	(5) FL onset[#] 1970–99
Prior war	-0.936	-1.293	-1.044	-0.990	-1.346
	(3.65)***	(4.06)***	(3.36)***	(3.16)***	(1.96)*
Per capita income[a, b] (ln)	-0.685	-0.225	-0.683	-0.782	-0.958
	(5.95)***	(1.08)	(3.96)***	(4.56)***	(2.75)***
Population[a, b] (ln)	0.253	0.216	0.167	0.225	0.520
	(4.20)***	(3.26)***	(2.34)**	(3.31)***	(4.56)***
Mountainous terrain[a] (ln)	0.201	0.209	0.247	0.257	0.277
	(2.43)**	(2.16)**	(2.62)***	(2.71)***	(2.04)**
Noncontiguous state	0.404	0.855	0.675	0.585	-0.223
	(1.51)	(2.71)***	(2.34)**	(2.05)**	(0.32)
Oil exporter	0.855	0.653	0.758	0.727	0.096
	(3.37)***	(2.39)**	(2.69)***	(2.69)***	(0.14)
New state	1.719	2.304	2.206	2.154	
	(5.16)***	(4.96)***	(4.70)***	(4.54)***	
Instability[a]	0.627	0.767	0.772	0.781	0.596
	(3.06)***	(3.18)***	(3.17)***	(3.19)***	(1.61)
Democracy[a]	0.018	0.013	0.014	0.015	0.022
	(1.05)	(0.64)	(0.65)	(0.69)	(0.53)
Ethnic fractionalization	0.285	0.452	0.718	0.556	0.560
	(0.87)	(1.00)	(1.60)	(1.23)	(0.72)
Religious fractionalization	-0.129	-0.039	-0.304	-0.418	-0.728
	(0.25)	(0.06)	(0.53)	(0.73)	(0.76)
Footprint per capita (ln)		-1.315			
		(4.50)***			
Bio-capacity per capita (ln)			-0.369		
			(2.37)**		
Ecological reserve per capita (ln)				-0.478 (1.33)	
Genuine Savings per capita (ln)					-2.617 (3.29)***
Constant	-2.268	-4.994	-1.457	-0.163	22.640
	(2.08)**	(2.75)***	(0.93)	(0.08)	(2.36)**
Observations	6327	4,651	4,651	4,651	2159

Robust z statistics in parentheses

[#] new state drops out due to collinearity

* significant at 10%; ** significant at 5%; *** significant at 1%

[a] Lagged one year

[b] In 1,000s

Table 2 Logit analyses of Ecological Footprint and Genuine Savings on onset of Uppsala-PRIO internal armed conflict

	(1) UP onset 1947–99	(2) UP onset 1961–99	(3) UP onset 1961–99	(4) UP onset 1961–99	(5) UP onset[#] 1970–99
Prior war	-0.007	-0.309	-0.173	-0.128	-0.715
	(0.03)	(1.01)	(0.58)	(0.42)	(1.89)*
Per capita income[a, b] (ln)	-0.463	-0.037	-0.405	-0.467	-0.570
	(4.30)***	(0.18)	(2.95)***	(3.55)***	(2.47)**
Population[a, b] (ln)	0.276	0.230	0.192	0.244	0.362
	(5.32)***	(3.67)***	(2.72)***	(3.50)***	(4.05)***
Mountainous terrain[a] (ln)	0.124	0.096	0.132	0.130	0.086
	(2.12)**	(1.42)	(2.09)**	(2.02)**	(0.80)
Noncontiguous state	0.016	0.495	0.391	0.329	0.788
	(0.07)	(1.82)*	(1.54)	(1.29)	(1.93)*
Oil exporter	0.891	0.724	0.818	0.808	0.995
	(3.21)***	(2.49)**	(2.62)***	(2.57)**	(2.77)***
New state	1.325	1.424	1.300	1.274	
	(3.43)***	(2.72)***	(2.52)**	(2.42)**	
Instability[a]	0.284	0.348	0.320	0.313	0.113
	(1.40)	(1.57)	(1.43)	(1.40)	(0.35)
Democracy[a]	0.019	0.014	0.016	0.017	0.018
	(1.36)	(1.04)	(1.16)	(1.16)	(0.67)
Ethnic fractionalization	0.969	1.121	1.292	1.184	1.736
	(3.38)***	(2.97)***	(3.35)***	(3.02)***	(2.86)***
Religious fractionalization	-0.454	-0.531	-0.764	-0.829	-0.752
	(1.01)	(1.08)	(1.65)*	(1.77)*	(1.11)
Footprint per capita (ln)		-0.900			
		(3.31)***			
Bio-capacity per capita (ln)			-0.234		
			(2.27)**		
Ecological reserve per capita (ln)				-0.158 (0.52)	
Genuine Savings per capita (ln)					-2.417 (2.82)***
Constant	-3.341	-5.670	-2.824	-2.521	19.775
	(3.32)***	(3.61)***	(2.65)***	(1.75)*	(2.19)**
Observations	6180	4627	4627	4627	2159

Robust z statistics in parentheses

[#] new state drops out due to collinearity

* significant at 10%; ** significant at 5%; *** significant at 1%

[a] Lagged one year

[b] In 1,000s

Table 3 Logit analyses of Ecological Reserve per capita on onset of internal conflict				
	(1)	(2)	(3)	(4)
	FL onset	FL onset	UP onset	UP onset
	1961–99	1961–99	1961–99	1961–99
Prior war	-1.043	-1.082	-0.132	-0.169
	(3.28)***	(3.31)***	(0.43)	(0.55)
Per capita income[a, b] (ln)	-0.628	-0.590	-0.455	-0.401
	(3.40)***	(3.02)***	(3.14)***	(2.63)***
Population[a, b] (ln)	0.249	0.240	0.245	0.230
	(3.33)***	(2.86)***	(3.45)***	(3.02)***
Mountainous terrain[a] (ln)	0.235	0.237	0.129	0.130
	(2.41)**	(2.46)**	(1.96)**	(2.02)**
Noncontiguous state	0.654	0.680	0.333	0.354
	(2.34)**	(2.19)**	(1.31)	(1.31)
Oil exporter	0.659	0.690	0.805	0.823
	(2.52)**	(2.52)**	(2.59)***	(2.53)**
New state	2.163	2.191	1.272	1.312
	(4.58)***	(4.62)***	(2.42)**	(2.50)**
Instability[a]	0.780	0.778	0.313	0.329
	(3.22)***	(3.26)***	(1.40)	(1.47)
Democracy[a]	0.012	0.007	0.017	0.009
	(0.57)	(0.33)	(1.14)	(0.61)
Ethnic fractionalization	0.470	0.606	1.185	1.305
	(1.00)	(1.25)	(3.01)***	(3.26)***
Religious fractionalization	-0.335	-0.322	-0.825	-0.794
	(0.56)	(0.53)	(1.75)*	(1.64)
Ecological reserve per capita (ln)	28.030	26.194	0.951	1.504
	(2.01)**	(1.95)*	(0.19)	(0.30)
Ecological reserve per capita^2 (ln)	-5.252	-4.858	-0.198	-0.251
	(2.06)**	(2.01)**	(0.22)	(0.29)
Density (ln)		0.087		0.105
		(0.53)		(1.01)
Constant	-39.823	-38.302	-4.145	-5.914
	(2.03)**	(1.98)**	(0.54)	(0.75)
Observations	4,651	4588	4627	4564

Robust z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

[a] Lagged one year

[b] In 1,000s

[g:/green giant/ISA paper 2006/Green giant ISA.doc/0703069