

What are the environmental impacts of property rights regimes in forests, fisheries and rangelands?: a systematic review protocol

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Abstract

Background

Property rights to natural resources comprise a major policy instrument for those seeking to advance sustainable resource use and conservation. Despite decades of policy experimentation and empirical research, however, systematic understanding of the influence of different property rights regimes on resource and environmental outcomes remains elusive. A large, diverse, and rapidly growing body of literature investigates the links between property regimes and environmental outcomes, but has not synthesized theoretical and policy insights within specific resource systems and especially across resource systems. Here we provide a protocol for conducting a systematic review that will gather empirical evidence over the past two decades on this topic. We will ask the following questions: a) What are the environmental impacts of different property regimes in forests, fisheries, and rangelands? b) Which property regimes are associated with positive, negative or neutral environmental

outcomes? c) How do those environmental outcomes compare within and across resource systems and regions?

Methods

We will assess current knowledge of the environmental impacts of property rights regimes in three resource systems in developing countries: forests, fisheries and rangelands. These resource systems represent differing levels of resource mobility and variability and capture much of the range of ecosystem types found across the globe. The review will use a bundle of rights approach to assess the impacts of three main property regimes—state, private, and community—as well as mixed property regimes that involve some combination of these three. Assessment of the impacts of property rights regimes across a range of different resource systems and ecosystem types will enable exploration of commonalities and differences across these systems. Our analysis will emphasize major insights while highlighting important gaps in current research.

Keywords

Property rights, Tenure, Bundle of rights, Forests, Fisheries, Rangelands, Environmental impacts

Background

Debate over the effects of different property regimes on natural resource systems has long been controversial, incited by Hardin's [1] thesis that common pool resources will inevitably suffer from overexploitation and degradation. Moreover, the dominant paradigm long held that government or private property was required for conservation and sustainable resource use. In response, a large body of scholarship has demonstrated that widening the breadth of property rights held by local-level actors in common property regimes can lead to more efficient and effective outcomes for resource sustainability [2-4]. Devolution of property rights to community and local level actors has since been used as an instrument for achieving goals as disparate as poverty alleviation [5], gender equity [6], resource conservation [7], and climate change mitigation [8]. Of course, states have also retained or claimed new property rights or allocated them to private sector actors in the name of these same goals [9].

A large, diverse, and rapidly growing body of literature has investigated the links between these property regime transitions and their environmental outcomes. A significant portion of the literature assesses recent decentralization policies, broadly described as tenure reforms, that transfer decision-making rights and authority from central to local governments or formally recognized existing de facto rights at the local level. Another branch of literature assesses the outcomes of initiatives for community-based natural resource management and community-based conservation. Thus far, the literature has yielded mixed findings on resource conditions and sustainability such as biodiversity loss, forest cover change [10], fisheries decline [11], and rangeland degradation [12]. Despite the expanding literature, little has been done to account for the variation in environmental impacts which limits advances in policy making and management intervention. Moreover existing syntheses and reviews on property regimes focus mostly on community based management [13-15], although natural resources are governed through state, private and common property regimes across diverse ecological and political systems. Broadening the scope to examine outcomes in state and

private property regimes can give us valuable theoretical and policy insights on similarities and systematic differences within and across resource systems. The increasing emphasis on landscape approaches and thinking beyond individual resource systems makes informing policy and practice at multiple scales of governance even more crucial [16].

This systematic review will synthesize extant empirical evidence of the impacts of different property rights regimes on environmental outcomes in three resource systems at local to regional scales in developing countries: forests, fisheries and rangelands. Although this review will limit itself to the assessment of environmental outcomes, it will also consider context and mediating factors and will aim to determine more systematically which contextual elements matter most decisively. Accounting for the context is especially important since property regime transitions are not always unidirectional nor fully realized, leaving ample room for discrepancies between existing de facto and newly inscribed de jure regimes and conflicts between recognized and unrecognized actors [17].

Objectives of the review

The review seeks to answer the following primary question:

- What are the environmental impacts of different property regimes in forests, fisheries, and rangelands in developing countries?

It also poses two secondary questions:

- Which property regimes are associated with positive, negative or neutral environmental outcomes?
- How do those environmental outcomes compare within and across resource systems and world regions?

Assessment of the impacts of property rights regimes across a range of different resource systems and ecosystem types enables exploration of commonalities and differences across these systems. As the review is interested in looking both short term and long term results of property rights interventions, both terms impact as well as outcome will feature in the review. Appendix explains in detail the definitions of other key terms used in this review.

This review adopts a PICO (Population-Intervention-Comparator-Outcomes) framework to structure analysis of these research questions [18], summarized in Table 1.

Table 1 Research framework for Population-Intervention-Comparator-Outcomes (PICO)

POPULATION	INTERVENTION	COMPARATOR	OUTCOME MEASURES
Resource systems	Property Regimes		
Forests	State OR Private	Before and after intervention (temporal dimension) OR With and without the intervention, from a similar setting (spatial dimension)	Species diversity and abundance, forest cover, forest condition, tree density, biomass, carbon sequestration, measures of land degradation and desertification, forest loss, land conversion, measures of disturbances such as number of cut stumps, number of invasive species, etc.
Fisheries	OR Community	OR Both before and after AND with and without intervention (BACI)	Abundance of fish, fish size, diversity of species, biomass, health of coral, water quality, reproductive indicators, etc.
Rangelands	OR Mixed		Species diversity and abundance, plant and bare ground cover, proportion of different species, soil indicators, carbon sequestration, biomass, soil nutrient levels, number of supported animals etc.

Population

The population refers to the three resource systems: forests, fisheries and rangelands (see Appendix for operational definitions of each of these systems). We have chosen these systems due to the importance of the ecosystem services they provide as well as their broad geographical coverage, which includes much of the range of ecosystem types found across the globe. These three resource systems also represent differing levels of resource mobility and variability, thus introducing important variation in the biophysical nature of the resources they provide. We will exclude other natural systems as well as heavily human-modified systems such as irrigation systems and cities.

Intervention

The intervention refers to the introduction of a particular property rights regime, whether state, private, and community or some combination of these (mixed regimes). The intervention could also be the establishment of a protected area for the explicit objective of resource conservation, although these cases will be treated separately. The review uses a bundle of rights approach, introduced by Schlager and Ostrom [19], to examine how the distribution of access, withdrawal, management, exclusion, and alienation rights in state, private, community, and mixed property regimes affects resource outcomes. In addition, this review considers the right to income from resource use as part of the bundle of rights that comprise a property regime, defined as a system of rules governing access to and control over resources [20], and specifying permissible and forbidden actions in relation to use and management, responsibilities and obligations [2,21]. Also in the case of protected areas, the bundle of rights approach will be used as it captures well the different joint/mixed property rights arrangements present in protected areas.

Comparator

This review compares environmental outcomes based on analysis of studies using the following three methodologies: change from before to after the intervention (temporal

change), case control studies (with-without comparison), or a combination of both (a BACI—before-after-control-impact—design). This latter design is based on data from before and after the intervention of interest and in sites where the intervention took place and matched control sites that are similar as possible to the intervention sites except that there was no intervention. The BACI approach seeks to rule out potentially confounding effects and to increase confidence that outcomes observed were due to the intervention [22].

Reviewers anticipate that control sites will often be characterized by open access regimes, but they may be any of the different property rights regimes identified as long as they were present in both treatment and control sites prior to the treatment (change in property rights regime). Moreover, the socioeconomic and environmental baselines of control and treatment sites should be of sufficient similarity such that divergent environmental results, if any, are attributable to the intervention or named contextual factors. In the case of protected areas, the comparison will need to present temporal comparison (before-after) within the protected area or spatial comparison with another regime outside the protected area.

Outcomes

The outcome of interest in this analysis consists of qualitative and quantitative changes in environmental measures, which may vary by resource system. Table 1 includes illustrative outcome indicators likely to be found in relevant studies. Based on information on change and/or difference in these indicators in each study, reviewers will determine whether the environmental outcomes associated with different property regimes were positive, negative or neutral. Both the original outcome measures reported in the studies under review and the reviewers' assessment of environmental outcomes will be recorded.

Methods

Searches

To capture as unbiased and comprehensive a set of relevant literature as possible within the constraints of the review budget, time allocation, and familiarity with languages, the search will be conducted in the databases shown in Table 2. Searches conducted on Google and Google Scholar will be limited to the first 200 hits retrieved. Any links will be followed only once from the original hit. Previous systematic reviews on the topic [13,15,23-25] and literature reviews assessing tenure and environmental outcomes that are identified by the search will be hand-searched to identify further relevant studies.

Table 2 The list of databases and other data sources for the systematic review**Primary research databases**

Agris	http://agris.fao.org/
Agricola	http://agricola.nal.usda.gov/
CAB Abstracts	http://www.cabdirect.org/
SciELO - Scientific Electronic Library Online	http://www.scielo.org/
Scopus	http://www.scopus.com/
Web of Knowledge	http://www.webofknowledge.com
General web search engines	
Google	www.google.com
Google Scholar	www.scholar.google.com
Research institutes, research networks and universities	
Agriculture Network Information Center (AgNIC) at Colorado State	http://lib.colostate.edu/agnic
Center for International Forestry Research	http://www.cifor.org
Centro de Informacion de Recursos Naturales	http://www.ciren.cl/web/
Centro de Investigaciones Pesqueras MINAL	http://www.ecured.cu/index.php/Centro_de_Investigaciones_Pesqueras
CGIAR System-wide Program on Collective Action and Property Rights	http://www.capri.cgiar.org/
CIRAD	http://www.cirad.fr/
Coalition of European Lobbies for Eastern African Pastoralism (CELEP)	http://www.celep.info
Digital Library of the Commons	http://dlc.dlib.indiana.edu/dlc/
Facultad Latinoamericana de Ciencias Sociales (FLACSO)	http://www.flacso.org/
Fondo de Conservacion de Bosques Tropicales Paraguay	http://www.fondodeconservaciondebosques.org.py/
Institut de recherché pour le développement (IRD)	www.ird.fr
Institut des sciences humaines et sociales (INSHS) du centre national pour la recherche scientifique (CNRS)	http://www.cnrs.fr/inshs/recherche/librairie/176.htm
Instituto del Mar del Peru	http://www.imarpe.pe/imarpe/
Instituto Mamiraua	http://www.mamiraua.org.br/pt-br
International Food Policy Research Institute	http://ifpri.org
International Institute for Fisheries Economics and Trade (IIFET)	http://oregonstate.edu/dept/iifet/
International Livestock Research institute	http://ilri.org
Lincoln Institute of Land Policy	http://www.lincolninst.edu/
Nelson Institute Land Tenure Center	http://www.nelson.wisc.edu/ltc/
PLAAS	http://www.plaas.org.za/
The Organization for Social Science Research in Eastern and Southern Africa (OSSREA)	http://publications.ossrea.net/
Thèses.fr (French master thesis and PhD)	http://www.thèses.fr
Universidad de los Andes (Colombia)	http://www.uniandes.edu.co/
Universidad Nacional Autonoma de Mexico	http://www.unam.mx/
University of Wageningen library	http://www.wageningenur.nl/
Western Indian Ocean Marine Science Association (WIOMSA)	http://www.wiomsa.org
World Agroforestry Center	http://www.worldagroforestrycentre.org/

WorldFish	http://worldfishcenter.org
International organizations and donor agencies	
US Agency for International Development (USAID)	http://usaid.gov
African development bank database (AfDB)	http://www.afdb.org/en/documents/
African Journals online	http://www.ajol.info/
Amazonia	http://amazonia.org.br/
Asian Development Bank (ADB)	http://www.adb.org/publications
Banco interamericano de desarrollo (BID)	http://publications.iadb.org
Centro Peruano De Estudios Sociales (CEPES)	http://www.cepes.org.pe/portal/
DIVERSITAS	http://www.diversitas-international.org
EuropeAid european union cooperation and development agency	http://ec.europa.eu/europeaid/multimedia/index_en.htm
European Tropical Forest Research Network	http://www.etfrn.org
Food and Agriculture Organization (FAO)	http://www.fao.org
German GIZ Gessellschaft fur Internationale Zusammenarbeit	https://www.giz.de/en/mediacenter/library.html
Institute of Development Studies	http://www.eldis.org/go/topics/resource-guides/environment
Instituto Brasileiro de Geografia e Estatica	http://www.ibge.gov.br/english/
International Geosphere-Biosphere Program (IGBP)	http://www.igbp.net
International Institute for Environment and Development (IIED)	http://www.iied.org
NEAD	http://www.nead.gov.br/portal/nead/
ODI overseas development institute	http://www.odi.org.uk/publications
Permanent Institution of the International Federation of Surveyors	http://www.oicrf.org/
The International Human Dimension Programme on Global Environmental Change (IHDP)	http://www.ihdp.unu.edu
The Organisation for Economic Co-operation and Development (OECD)	http://www.oecd.org/
The World Bank	http://worldbank.org
Tierra Fundacion	http://www.ftierra.org/
UK department for international development	https://www.gov.uk/government/publications
UNESCO	http://www.unesco.org/new/fr/unesco/resources/publications/
United Nations Convention to Combat Desertification (UNCCD)	http://www.unccd.int/
United Nations Development Programme (UNDP)	http://www.undp.org
United Nations Environment Programme (UNEP)	http://www.unep.org/
United Nations University	http://unu.edu/
World bank and IMF library (JOLI)	http://external.worldbankimflib.org/external.htm
World Resources Institute (WRI)	http://www.wri.org/
NGOs, Think Tanks	
aGter	http://www.agter.asso.fr/rubrique139_fr.html
Alimenterre platform and ressources	http://www.alimenterre.org/recherche/r%C3%A9gime%20foncier
AVSF agronomes et vétérinaires sans frontières	http://www.avsf.org/fr/recherche_avancee
Community Forestry International	http://www.communityforestryinternational.org/

Conservation Gateway (TNC)	http://www.conservationgateway.org
Conservation International	http://www.science2action.org
CORDIO	http://cordioea.net/
Equator initiative	http://www.equatorinitiative.org/
GRAF action and research on tenure group in the Sahel	http://www.graf-bf.org/spip.php?rubrique4
International Land coalition	http://www.landcoalition.org/
International Union for Conservation of Nature (IUCN)	http://www.iucn.org/wisp/resources/publications
Landesa	http://www.landesa.org/
Landportal	http://landportal.info/
le Hub Rural (west and central africa platform)	http://www.hubrural.org/base_documentaire.html?lang=fr
LMMA Network	http://www.lmmanetwork.org
Oakland Institute	http://www.oaklandinstitute.org/
Rainforest Portal	http://www.rainforestportal.org/
ReefBase	http://www.reefbase.org/pacific
Resources for the Future	http://www.rff.org
Rights and Resources Initiative	www.rightsandresources.org
Tenure observatory of Madagascar (observatoire foncier de madagascar)	http://www.observatoire-foncier.mg/
The Center for People and Forests (RECOFTC)	http://www.recoftc.org
Tropenbos International	http://www.tropenbos.org

Electronic search strategies have been tested using the ISI Web of Knowledge, CAB Abstracts and Google Scholar. This testing process has been documented and informs this protocol (see Appendix). The following search terms will be applied to the different databases, with search term and database specific modifications. As the operation of websites and database-specific search engines varies greatly, the reviewers will modify their search and search terms for each database in order to retrieve results that balance the needs for sensitivity and specificity to the review question [18]. If use of several search terms is impossible, the reviewers will take advantage of available topic-relevant key words and publication categorizations. Reviewers will also adjust for different word permutations or suffixes through the use of wildcard symbols, where applicable. The development and implementation of the search strategy will be recorded, including the testing process, number of hits, relevance of the results and the date of search. The reviewers will also contact individual organizations (through librarians or other information specialists) for further guidance.

To reduce language bias that may be associated with limiting the review to English language publications, the search will be also conducted in French and Spanish. Search in French and Spanish will be conducted in Google, Google Scholar as well as in primary databases where applicable. In addition, reviewers will conduct search for grey literature within institutions and NGOs whose main language is French or Spanish, e.g. CIRAD (French) and Facultad Latinoamericana de Ciencias Sociales (Spanish). In order to take benefit from all the languages mastered by the review team an additional search in Indonesian will be conducted where applicable. The databases will be searched with following English terms and with their French, Spanish and Indonesian translations.

Population terms: Forest, fish, marine, grassland, pastoralist, pasture, rangeland

Intervention terms: Collective, common, community, customary, government, public, private, small-scale, state, public, private, company, concession, participatory, collaborative, co-operative, co-manage, shared, joint

Intervention-related terms: Decentralization, tenure, reform, allocation, ownership, property right, property rights, property regime, property system, management, access, harvest, open access

Examples how search words will be combined are presented in Table 3. Searches will also be conducted using different institutional accesses (CIFOR, University of Michigan and University of Oxford) to take advantage of different subscription databases.

Table 3 List of search terms in Google Scholar⁽¹⁾, WOK⁽¹⁾ and CAB⁽¹⁾

Google Scholar (english)	(fish OR fisheries OR rangeland OR grassland OR pasture OR forest) AND (common OR community OR government OR state OR public OR private) AND (tenure OR property OR rights) Search results were limited to 1990 onwards
WOK	<p>Topic=(forest* or fish* or marine or grassland* or pastoralis* or pasture or rangeland*) AND Topic=(decentraliz* or tenure or reform* or allocation or ownership or "property right" or "property rights" or "property regime" or "property system" or manag* or access or harvest* or open?access) AND Topic=(collective or comm?n* or small?scale or customary or state or public or privat* or compan* or concession* or participat* or collaborative or co?operative or co-manage* or shared or joint) AND Topic=(Armenia* or Bhutan* or Bolivia* or Cameroon* or "Cape Verde" or "Côte d'Ivoire" or "Ivory Coast" or Djibouti* or Egypt* or "El Salvador" or Georgia* or Ghana* or Guatemala* or Guyan* or Hondura* or Indonesia* or India* or Kiribati* or Lao* or Lesotho* or Mauritania* or Micronesia* or Mongolia* or Morocc* or Nicaragua* or Nigeria* or Pakistan* or Papua* or Paraguay* or Philippin* or Samoa* or "Sao Tome" or Senegal* or "Solomon Islands" or "Sri Lanka" or Sudan* or Swaziland*) OR</p> <p>OR Topic=(Afghan* or Bangladesh* or Benin* or Burkina* or Burundi* or Cambodia* or Central African Republic or Chad* or Comoro* or Congo* or Eritrea* or Ethiopia* or Gambia* or Guinea* or Haiti* or Kenya* or Korea* or Kyrgyz* or Liberia* or Madagascar* or Malagasy* or Malawi* or Mali* or Mozambique* or Myanmar* or Burma* or Nepal* or Niger* or Rwanda* or Sierra Leone or Somali* or Sudan* or Tajikistan* or Tanzania* or Togo* or Uganda* or Zimbabwe*)</p> <p>OR Topic=(Angola* or Algeria* or Samoa* or Argentina* or Azerbaijan* or Beliz* or Botswana* or Brazil* or Chin* or Colombia* or "Costa Rica" or "Costa Rican" or Cuba* or Dominica* or Equatorian* or Ecuador* or Fiji* or Gabon* or Grenad* or Iran* or Iraq* or Jamaica * or Jordan* or Kazak* or Leban* or Libya* or Malaysia* or Maldives or "Marshall Islands" or Mayotte or Mauritius or Mexic* or Namibia* or Palau* or Panama* or Peru * or Seychell* or "South Africa" or "St! Lucia" or "St. Vincent" or Suriname* or Thai* or Tonga* or Tunisia* or Turk* or Turkmenistan* or Tuvalu* or Venezuela*)</p> <p>Search results were limited to 1990-2013</p>

CAB (forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:((tenure OR “property rights” OR “property regime” OR “property system” OR “common property resources”)) AND yr:[1990 TO 2014]
OR AND subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:("tenure systems" OR "property rights" OR "property regime" OR "property system" OR "common property resources") AND yr:[1990 TO 2014]

⁽¹⁾The symbol asterisk (*) is a truncation operator and presents zero or more characters in a search term. Forest* would thus include forests, forestry, forester, forestal etc. It was not used in Google Scholar as the search engine does not recognize truncation symbols.

Study inclusion and exclusion criteria

Inclusion criteria will be applied to select the relevant articles captured by the search. Inclusion criteria will be applied to the titles and abstracts of articles. Studies will be included if they fulfill the following criteria.

Type of study

Only primary empirical literature will be included, such as case studies, case–control studies and cohort studies, including quantitative and qualitative research.

Subjects studied: We will include studies that assess any property regime associated with forests, fisheries and rangelands. Studies need to assess outcomes from before/after change in a property regime (temporal dimension), assess outcomes from different regimes in a with/without setting (spatial dimension), or a combination of these (BACI). Papers reviewing environmental outcomes without a reference to a specific property regime will not be included, nor will studies of plantation forests and aquaculture. The review will exclude commentary and position papers.

Outcomes

Studies must measure and/or qualitatively assess change and/or difference in environmental outcomes as illustrated Table 1.

Regional focus

Studies will only be included if the research focuses on the developing countries of Latin America and the Caribbean, Africa, and Asia and the Pacific (see Appendix for complete list of countries). Developing countries are those defined as either low or middle income according to the World Bank. We will use this classification rather than others (such as OECD/non-OECD), as the division into low and middle income countries enables synthesis that includes economic context.

Timeframe

Studies need to have been published between 1990-present.

Based on the inclusion criteria described above, the review will use a three-step process to identify studies for inclusion.

- (1) Studies clearly not relevant will be excluded on the basis of titles only
- (2) Studies with potentially relevant titles will be assessed using their abstracts.
- (3) Any potentially relevant study that gets through stages 1 and 2 will be collected and assessed for inclusion as full text.

A kappa statistic – the standard measurement used in previous systematic reviews [15],[13] to check for consistency - will be calculated for all reviewers involved in screening prior to work on inclusion. This has been trialed during protocol development and moderate to high levels of consistency have been achieved during these trials. Once satisfactory kappa statistics has been achieved for our final set of screeners, reviewers will determine separately which papers fulfill the inclusion criteria at each step for batches of publications.

To check for consistency of the selection at each stage, two authors will review a 10% random subsample of abstracts and full texts at these screening stages. If too many differences between inclusion and exclusion are perceived, further discussion on interpretations and possible revision of the criteria will be done iteratively until a satisfactory kappa figure is achieved, following best practice with other published systematic reviews. We will also record the reasons for exclusion at full text for each article and provide this information as an appendix in the final systematic review

Potential effect modifiers and reasons for heterogeneity

The following potential effect modifiers related to the environmental, socio-economic, and political context of the intervention will be considered and recorded:

Environmental context

- Location
- Ecosystem type
- Spatial extent of resource area
- Elevation
- Accessibility
- Baseline resource condition
- Existence of external environmental management intervention

Socio-economic context

- Population density in study/resource area
- Change in population in study/resource area
- Local and external market demand on resource
- Economic inequality (information stated in study, GINI coefficient, etc.)
- Presence of education initiatives
- Presence of infrastructure

Political context

- Nature of political regime (democracy, authoritarian, totalitarian)
- Decentralization (whether decentralized or decentralizing; year decentralization process began; extent of decentralization: advanced; not advanced)
- Corruption (no corruption, low corruption, high corruption according to study; other measures of corruption, e.g. WGI, Transparency International)

The following additional characteristics of property regime interventions will also be noted where information is available in the study:

- Clarity of rights
- Stability of rights
- Level of enforcement
- Legitimacy of decision-making authority over rights
- Gender equality of property rights
- External support: whether the regime is supported by external actors, such as NGOs, donors, or companies
- Formal protected area: Whether property rights regime applies to a legally protected area

The variables listed above were identified based on consultation with experts in the field of property rights and natural resource governance and knowledge among the review team of the empirical and theoretical literature relevant to this review. The reviewers have winnowed the number of potentially relevant variables to a manageable set that addresses especially salient hypotheses in this area of inquiry.

Study quality assessment

Once all relevant articles have been identified, full texts will be reviewed to assess study quality according to the questions below. These questions are based on recommendations by the Cochrane Collaboration [26] as well as previous reviews [13], but have been modified to account for the realities of available research on the impacts of property rights, which is characterized by an extensive number of qualitative case studies [27]. Two researchers will code a 10% random sample of articles to test the coding protocol and intercoder reliability. Kappa values will be calculated to assess agreement and if agreement is less than 50% the researchers will adjust the coding protocol to increase clarity and agreement.

Questions and coding system used to guide the quality assessment

1. Clarity and replicability of methods: Are the research methods clearly presented so that the research could be repeated? [clear and repeatable = 1, not clear and repeatable = 0]
2. Appropriateness of methods: Are the research methods appropriate for addressing the research question(s)? [appropriate = 1, not appropriate = 0]
3. Study design category: Which of the following categories is most appropriate to describe this study? [cross sectional study or time series study = 0; case control study = 1; controlled before-and-after (BACI) study = 2]
4. Sample size: Is sample size explained and well justified? [yes = 1, no = 0]
5. Confounding factors: Did the study account for and seek to minimize the effects of

potential confounding factors in its design and analysis? [yes = 1, no = 0]

Studies will be assessed based on the above quality categories. The quality of each study will be scored based on the above questions, with results recorded in a separate Excel spreadsheet. Explanations for each decision will be recorded in order to keep the process transparent and repeatable.

However, for those identified studies that fail the quality requirements (scoring 0 on our quality assessment scale), a sensitivity analysis will be conducted during the data analysis stage to determine the effect of their inclusion on the results of our systematic review. Should their results be markedly different from those of studies that met quality criteria, they will be discarded from the final synthesis. These studies will be available for analysis if the sensitivity analysis indicates that the review would be richer with their inclusion. We will in any case capture the numbers that have been assessed at different quality levels in graphical representations of the state of the evidence base.

In addition, reviewers will also record the type of the data analysis used in each case study according to the following typology:

- qualitative analysis
- quantitative analysis -descriptive or observational statistics
- quantitative analysis – analysis of variance, t-test, statistical correlation or other bivariate analysis
- quantitative analysis-multivariate regression or other multivariate analysis

Data extraction strategy

Data on individual property regime interventions and their environmental outcomes will be collected in a data extraction matrix using an Excel spreadsheet. This will include information on the resource systems in which the property rights regime is implemented, the de jure and de facto nature of the regime as determined by the specific property rights accorded under each regime, stated objectives of the property rights regime intervention, intervention year, study year, the environmental outcomes of regime interventions, and confounding factors that may explain the nature and variation of the outcomes of the regime, including baseline environmental characteristics, external regime characteristics that may further enable the outcomes of an intervention (such as the stability of rights held and level of enforcement of the regime), and characteristics of the socio-economic and political context. A coding protocol has been developed and it is presented in Table 4. As the data extraction advances, other coding systems will be developed (e.g. resource systems, countries and geographic regions).

Table 4 Initial coding protocol for data extraction

• bundle of rights	S=State P = Private C = Community, 0 = undefined 1 = right defined
• clarity of rights	clear=1, unclear=0
• stability of rights	stable=1, unstable=0
• level of enforcement	no enforcement =0, low enforcement=1, high enforcement=2
• legitimacy of decision making	legitimate=1, not legitimate=0

authority over rights	
• external support	yes=1, no =0
• formally protected area x	yes=1, no =0
• corruption	high/low/no
• environmental condition	good/fair/poor
• environmental change	positive, negative, no change

To fully address geographic differences, we will collect not only country data but also data within subregions, and further take into account the varying ecosystem types within the broad categorizations of forests, rangelands, and fisheries by documenting individual ecosystem type. Should a paper present multiple studies of different property regimes, each of these will be recorded individually within the data extraction sheet. Thus if spatial comparisons of two regimes or comparisons of outcomes from multiple regimes are made, each regime will present an individual data entry.

Data synthesis and presentation

Our data synthesis will be based on the information categories mentioned in “Potential effect modifiers and reasons for heterogeneity” as well as “Data extraction strategy categories.” We will synthesize the results on environmental outcomes across different resource systems, ecosystem types and geographical regions. We will synthesize the environmental results considering the allocation of bundle of rights as well as the context factors. A series of matrices will be deployed to illustrate: a) how environmental outcomes may vary according to the bundle of rights allocation as well as the institutional arrangements that support (or not) the rights regimes, for example, security of rights as determined by enforcement, clarity, stability and legitimacy of authority; b) how contextual factors influence environmental outcomes; c) how environmental outcomes vary with resource type; and d) how a to c above vary in different geographical locations. The synthesis matrices will be accompanied by a narrative. We will also include a note on the performance of different methodologies in providing a nuanced understanding of the environmental effects of property regimes. A major outcome of the synthesis will be the identification of aspects that need further, in-depth inquiry as well as policy implications of current findings.

The variety of measured outcomes and possible lack of quantitative data will delimit the applicability of statistical tools. Data will be analyzed using regression and other statistical techniques (as far as possible) to complement qualitative, narrative analysis. The review will also explore whether or not to include sources for which a significant (33%-50%) portion of the data are missing as done in other relevant systematic reviews [13]. Finally, a sensitivity analysis will be conducted to synthesize the conclusions of studies that did not meet quality assessment standards, and consider differences (if any) from the results of those studies that were included in the final review. This will be done quantitatively if the data is so presented, or otherwise will be synthesized through qualitative methods using the same data extraction matrix.

It is well known that in many research areas papers are more likely to be published if they demonstrate clear, positive results (or strong negative effects), and that papers that shown little or no effect are less likely to be published than “negative”. To assess the possibility of such publication bias, we are conducting searches of ‘grey’ literature (much of it not formally published) in addition to studies in academic journals [28] will assess whether there is

evidence of publication bias. If data allow, we will assess bias using funnel plots, which show effect sizes and standard error or sample sizes [29].

Competing interests

The authors do not declare any conflicts of interest. This research is funded by the Center for International Forestry Research (CIFOR).

Authors' contributions

EM developed the research question. MO & WZ conducted pilot research. MO, DCM, WZ, BM and EM wrote the protocol with support from GP. All the authors MO, DCM, WZ, BM, EM and GP read and approved the final manuscript.

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Appendix

Glossary of key definitions and terms used in the review protocol

Forest: Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 percent. [30]

Wooded lands (woodland): Land either with a crown cover (or equivalent stocking level) of 5–10 percent of trees able to reach a height of 5 m at maturity, or a crown cover (or equivalent stocking level) of more than 10 percent of trees not able to reach a height of 5 m at maturity in situ (e.g. dwarf or stunted trees), or with shrub or bush cover of more than 10 percent. Wooded lands are included in this definition of forests [30].

Fishery: A geographical place, activity, or unit that is involved in raising and/or harvesting fish. As a unit, a fishery is typically defined in terms of some or all of the following: people involved, species or type of fish, area of water or seabed, method of fishing, class of boats and purpose of the activities [31].

Rangeland: Land on which the indigenous vegetation is predominantly grasses, grass-like plants, forbs, or shrubs and is managed as a natural ecosystem. If plants are introduced, they

are managed similarly. Rangelands included natural grasslands, savannas, shrublands, many deserts, tundras, alpine communities, marshes and meadows” [32].

Property rights: A property right is an enforceable claim to use, control or otherwise benefit from a resource [33,34]. Property rights is often made up of a bundle of multiple rights (and responsibilities) including [19]:

- Access is the right to enter a defined physical property
- Withdrawal is the right to enter a defined physical area and obtain resource units or products of a resource system (e.g., cutting firewood or timber, harvesting mushrooms, diverting water)
- Management is the right to regulate internal use patterns and transform the resource by making improvements (e.g., planting seedlings and thinning trees)
- Exclusion is the right to determine who will have right of withdrawal and how that right may be transferred
- Alienation is the right to sell or lease withdrawal, management, and exclusion rights.

The bundle of rights also include the right to earn income from a resource even without using it directly and is derived from permitting others to use the resource [35];[36].

Property rights regime: a system of rules governing access to and control over resources [20]. Rules specify permissible and forbidden actions in relation to use and management, responsibilities and obligations [2,21]. The holder of a property right can be an individual, a corporation, a group or the state/government:

- a) Private property: Individual or “legal individual” holds rights.
- b) Common property: group members hold rights (e.g. community)
- c) Public property: state holds the rights
- d) No-property or Open access: no one has rights and everyone can use the resource as they like; no effective management or regulation

List of developing countries included in the analysis

Income groups correspond to 2012 gross national income (GNI) per capita (World Bank Atlas method) [37]. We will take account of country name changes since 1990 in searching for studies from the relevant countries [38].

Low-income economies (\$1,035 or less)

Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Congo, Dem. Rep, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kenya, Kyrgyz, Liberia, Madagascar, Malawi, Mali, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sierra Leone, Somalia, South Sudan, Tajikistan, Tanzania, Togo, Uganda, Zimbabwe

Lower-middle-income economies (\$1,036 to \$4,085)

Armenia, Bhutan, Bolivia, Cameroon, Cape Verde, Côte d'Ivoire, Djibouti, Egypt, El Salvador, Georgia, Ghana, Guatemala, Guyana, Honduras ,Indonesia, India, Kiribati, Laos,

Lesotho, Mauritania, Micronesia, Mongolia, Morocco, Nicaragua, Nigeria, Pakistan, Papua, Paraguay, Philippines, Samoa, Sao Tome, Senegal, Solomon Islands, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Timor-Leste, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Yemen, Zambia

Upper-middle-income economies (\$4,086 to \$12,615)

Angola, Algeria, Samoa, Argentina, Azerbaijan, Belize, Botswana, Brazil, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, Fiji, Gabon, Grenada, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Lebanon, Libya, Malaysia, Maldives, Marshall Islands, Mauritius, Mexico, Namibia, Palau, Panama, Peru, Seychelles, South Africa, St. Lucia, St. Vincent and the Grenadines, Suriname, Thailand, Tonga, Tunisia, Turkey, Turkmenistan, Tuvalu, Venezuela

Documentation of search term testing conducted in CAB, Google Scholar and WOK

Testing process with search terms for CAB, Google Scholar and WOK. The search was conducted in the online CAB, Google Scholar and WOK databases by the authors WZ and MO, see table for detailed search terms, results, dates and comments on results

CAB Database: note that the preferred term for tenure is tenure systems; other dictionary terms include: common property resources, common lands, coownership, property rights; ownership on its own not useful This search was amended 12.5.2014.to include Descriptors and geographic locations based on reviewer suggestions.

Symbol * notes truncation in order to retrieve various endings

Search Changes	Search terms	Search results
1	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:(collective OR comm?n* OR customary OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership) AND subject:("tenure systems" OR property OR "property rights" OR "property regime" OR "property system" OR "common property resources" OR common lands) AND yr:[1990 TO 2013]	2,133 results; appears somewhat relevant although many soil/plant biology entries (OXFORD)
2 Removed common lands	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:(collective OR comm?n* OR customary OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership) AND subject:("tenure systems" OR property OR "property rights" OR "property regime" OR "property system" OR "common property resources") AND yr:[1990 TO 2013]	2,409 results; still many irrelevant biological studies (OXFORD)
3 Searched 2nd and 3rd lines in all fields rather than restricted to subject field alone	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND (collective OR comm?n* OR customary OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR	5,047 results; too many irrelevant results (OXFORD)

		coownership) AND ("tenure systems" OR property OR "property rights" OR "property regime" OR "property system" OR "common property resources") AND yr:[1990 TO 2013]	
4	Changed 2nd and 3rd line fields to descriptor	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND de:(collective OR comm?n* OR customary OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership) AND de:("tenure systems" OR property OR "property rights" OR "property regime" OR "property system" OR "common property resources") AND yr:[1990 TO 2013]	55 results; Very focused results but may be too narrow a search (OXFORD)
5	Changed 2nd and 3rd line fields back to subject; removed collective and property; added traditional	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:(comm?n* OR customary OR traditional OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership) AND subject:("tenure systems" OR "property rights" OR "property regime" OR "property system" OR "common property resources")	64 results; too few even without time limits! (OXFORD)
6	Added property* and right*	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:(comm?n* OR customary OR traditional OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership) AND subject:("tenure systems" OR property* OR right* OR "property rights" OR "property regime" OR "property system" OR "common property resources")	3559 results; again much noise comes in; traditional often refers to medicine/plants (OXFORD)
7	Removed traditional	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:(comm?n* OR customary OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership) AND subject:("tenure systems" OR property* OR right* OR "property rights" OR "property regime" OR "property system" OR "common property resources")	2,509 results; results appear mostly relevant (many articles are from US, and should be easy to discard) (OXFORD)
8	Added yr:[1990–2013]	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:(comm?n* OR customary OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership) AND subject:("tenure systems" OR property* OR right* OR "property rights" OR "property regime" OR "property system" OR "common property resources")	2446 results, showing that most relevant articles were written in review time span (OXFORD)
9	Added yr:[1990–2013]	IBID	
10	Changed yr:[2008–2013]	IBID	4,530 results

11	Removed property*	subject:((forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*)) AND subject:((comm?n* OR customary OR state OR public OR government OR private OR participat* OR collaborative OR cooperative OR coownership)) AND subject:(("tenure systems" OR "property rights" OR "property regime" OR "property system" OR "common property resources"))	1,668 results
12	Added yr:[2008 TO 2013]	IBID	509 results
13	Removed search string of regimetype	subject:(forest* OR fish* OR marine OR rangeland* OR grassland* OR pasture*) AND subject:(("tenure systems" OR "property rights" OR "property regime" OR "property system" OR "common property resources"))	2351 results; looks very relevant
14	Added yr:[2008 TO 2013]	IBID	723 results

Google Scholar (English)

Search Changes	Search terms	Search results	Search date
1	(forest OR fish OR marine OR rangeland OR grassland OR pastoralis OR pasture) AND (collective OR common OR community OR communal OR small-scale OR customary OR state OR public OR government OR private OR privatized OR company OR concession) AND (decentralization OR decentralize OR reform OR tenure OR allocation OR ownership OR property OR property right OR property regime OR property system)	8000 hits on Google Scholar, but bias towards decentralization studies	9.2.2013
2 Deleted small-scale, customary, decentralization, decentralize	(forest OR fish OR marine OR rangeland OR grassland OR pastoralis OR pasture) AND (collective OR common OR community OR communal OR state OR public OR government OR private OR privatized OR company OR concession) AND (reform OR tenure OR allocation OR ownership OR property OR property right OR property regime OR property system)	reform brings a lot of noise	9.2.2013
3 Deleted community, privatized, company, concession, reform, property right, property regime, property system	(forest OR fish OR marine OR rangeland OR grassland OR pasture) AND (collective OR common OR communal OR state OR public OR government OR private) AND (tenure OR allocation OR ownership OR property)	good first 20–30 results	9.2.2013
4 Changed order of	(fish OR fisheries OR marine OR	more results for	9.2.2013

	resource systems, added fisheries	rangeland OR grassland OR pasture OR forest) AND (collective OR common OR communal OR state OR public OR government OR private) AND (tenure OR allocation OR ownership OR property)	fisheries	
5	Added property right, property regime again	(fish OR fisheries OR marine OR rangeland OR grassland OR pasture OR forest) AND (collective OR common OR communal OR state OR public OR government OR private) AND (tenure OR allocation OR ownership OR property OR property right OR property regime)	much fewer, narrower results (around 450,000) - but great emphasis on common property, delimitation by time range further narrows results	9.2.2013
6	Enclosed phrases "property right", "property regime" is parentheses, deleted common	(fish OR fisheries OR marine OR rangeland OR grassland OR pasture OR forest) AND (collective OR communal OR state OR public OR government OR private) AND (tenure OR allocation OR ownership OR property OR (property regime) OR (property right))	many more results with the phrase "property right" in initial search results; some do not appear relevant to environmental issues	9.3.2013
7	Readded common	(fish OR fisheries OR marine OR rangeland OR grassland OR pasture OR forest) AND (collective OR common OR communal OR state OR public OR government OR private) AND (tenure OR allocation OR ownership OR property OR (property right) OR (property regime))	many more results with "common property", as found in search 5	9.3.2013
8	Readded community, manage, property system Removed allocation, ownership	(fish OR fisheries OR marine OR rangeland OR grassland OR pasture OR forest) AND (collective OR common OR communal OR community OR state OR public OR government OR private) AND (tenure OR manage OR property OR (property right) OR (property regime) OR (property system))	common property still come to the top of search results, collective seems to bring up mostly collective action results	9.3.2013
9	Removed collective, replaced manage with management	(fish OR fisheries OR marine OR rangeland OR grassland OR pasture OR forest) AND (common OR communal OR community OR state OR public OR government OR private) AND (tenure OR management OR property OR (property right) OR (property regime) OR (property system))	results are not too different	9.3.2013
10	Added rights terms: access, withdrawal, exclusion, exclude, alienate, alienation	(fish OR fisheries OR marine OR rangeland OR grassland OR pasture OR forest) AND (common OR communal OR community OR state OR public OR government OR private) AND (tenure OR property OR	results are not well targeted; limitation by time (2008-present) makes results more irrelevant	9.3.2013

		(property right) OR (property regime) OR (property system)) AND (management OR access OR withdrawal OR exclusion OR exclude OR alienate OR alienation)	
11	Removed rights terms, communal, property right, property regime, property system	(fish OR fisheries OR rangeland OR grassland OR pasture OR forest) AND (common OR community OR state OR public OR government OR private) AND (tenure OR property)	9.3.2013
12	Added rights	(fish OR fisheries OR rangeland OR grassland OR pasture OR forest) AND (common OR community OR government OR state OR public OR private) AND (tenure OR property OR rights)	9.3.2013 emphasis on common property, community management, but first pages of search results look good
13	Added management	(fish OR fisheries OR rangeland OR grassland OR pasture OR forest) AND (common OR community OR government OR state OR public OR private) AND (tenure OR property OR rights OR management)	9.3.2013 management gives broad policy results
14	Removed management, added ownership	(fish OR fisheries OR rangeland OR grassland OR pasture OR forest) AND (common OR community OR government OR state OR public OR private) AND (tenure OR property OR rights OR ownership)	9.3.2013 ownership adds no new results of pertinence

WOK database	Hits	Date	Comments
Symbol (*) notes truncation in order to retrieve various endings			
stock OR resource OR population AND common* AND property	6637	16.4.2013	Obviously needs a better description of the resource
fish* OR forest* OR rangeland* OR pasture OR cattle AND comm* AND govern* AND property OR right*	1463	16.4.2013	still too much noise
fish*, forest*, rangeland*, pasture, cattle AND common OR community OR private OR shared AND access OR management	88308	22.4.2013	Management brings noise
fish*OR forest* OR rangeland* OR pasture OR cattle AND common property OR common-pool OR privat* AND access OR management AND effect* AND benefit*	3301	22.4.2013	Seem relevant
fish*OR forest* OR rangeland*, pasture OR cattle	28971	22.4.2013	Too huge number

AND common OR private OR shared AND property OR rights OR quota* OR tenure OR title OR deed

fish* OR forest* OR pasture 4914 24.4.2013 Seem relevant
 OR rangeland* OR cattle AND tenure or reform or regime or rule* or quota* or customary AND impact* OR effect* OR effectiveness OR benefit* AND common property or "common-pool" or "community-based" or state or private "community-controlled" AND access or management or use* or withdrawal or harvest or monitor

fish* OR forest* OR pasture 5064 24.4.2013 rules leads to misleading results
 OR rangeland* OR cattle AND tenure or reform or property or rule* or quota* or custom* or transfer* AND impact* OR effect* OR benefit* AND common property or "common-pool" or "community-based" or state or private "community-controlled" AND access* or management or harvest* or monitor*

fish* OR forest* OR pasture 4702 24.4.2013 replaced rules with governance, transfer still brings misleading results
 OR rangeland* OR cattle AND tenure or reform or property or governance or quota* or custom* or transfer* AND impact* OR effect* OR benefit* AND common property or "common-pool" or "community-based" or state or private "community-controlled" AND access* or management or harvest* or monitor*

fish* OR forest* OR pasture 6919 24.4.2013 changed governance into govern*, removed transfer
 OR rangeland* OR cattle AND tenure or reform or property or govern* or quota* or custom* AND impact* OR effect* OR benefit* AND common property or "common-pool" or "community-based" or state or private or "community-controlled" or "open-access" AND access* or management or harvest* or monitor*

<p>fish* OR forest* OR pasture OR rangeland* OR cattle AND tenure or reform or govern* or quota* or custom* AND impact* OR effect* OR benefit* AND common property or " common-pool" or "community-based" or state or private or "community- controlled" or "open-access" AND access* or management or harvest* or monitor*</p>	<p>4001 24.4.2013 removed property because it brings noise</p>
<p>fish* OR forest* OR pasture OR rangeland* OR cattle AND tenure or reform or govern* or custom* AND right* or ownership* AND common property or " common-pool" or "community-based" or "community-controlled" or "open-access"</p>	<p>938 25.4.2013 remove state, private and quota</p>
<p>fish* OR forest* OR pasture OR rangeland* OR cattle AND tenure or reform or govern* or custom* AND common property or " common-pool" or "community-based" or "community-controlled" or "open-access" AND biodivers* or divers* or loss or deplet* or deforestation or conservation AND sustainab*</p>	<p>316 25.4.2013 inserted environmental outcomes and sustainability, because many articles did not mention environmental outcomes</p>
<p>fish* OR forest* OR pasture OR rangeland* OR cattle AND tenure or reform or govern* or custom* AND common property or " common-pool" or "community-based" or "community-controlled" or "open-access" or private or state AND biodivers* or divers* or loss or deplet* or deforestation or conservation or benefit* AND sustainab*</p>	<p>1264 25.4.2013 added state and private</p>
<p>fish* OR forest* OR pasture OR rangeland* OR cattle AND biodivers* or divers* or loss or deplet* or deforestation or degradation or conservation AND benefit* or sustainab* or improv* or effect* AND tenure or regime or management or access or right AND tenure or reform or governance or</p>	<p>3035 25.4.2013 testing with sustainability indicators</p>

customary			
rangeland OR pasture or pastoralist* AND biodivers* or divers* or loss or deplet* or deforest* or degradat* or conservation AND benefit* or sustainab* or improv* or effect* AND community-based or "community-controlled" or "open-access" or enclosure	270	30.4.2013	trying with rangeland and pasture and pastoralist. Management brings too much noise, also enclosure needs a more descriptive attribute
rangeland OR pasture or pastoralist* AND biodivers* or divers* or loss or deplet* or overgraz* or degradat* or conservation AND benefit* or sustainab* or improv* or effect* AND community-based or community-controlled or open-access or tenure or property or collective	2977	30.4.2013	removing enclosure and adding overgrazing
rangeland OR pasture or pastoralist* AND biodivers* or divers* or loss or deplet* or overgraz* or degradat* or conservation AND benefit* or sustainab* or improv* or effect* AND community-based or community-controlled or open-access or tenure or property rights or collective	614	30.4.2013	inserting property rights
rangeland OR pasture or pastoralist* AND biodivers* or divers* or loss or deplet* or overgraz* or degradat* or conservation AND benefit* or sustainab* or improv* or effect* AND community or open-access or tenure or property rights or collective or privatization	8154	30.4.2013	inserting just community and privatization
rangeland OR pasture or pastoralist* AND biodivers* or divers* or loss or deplet* or overgraz* or degradat* or conservation AND benefit* or sustainab* or improv* or effect* AND community managed or "community based" or "community controlled" or tenure or property rights or collective or privatization	604	30.4.2013	community-based returns a lot of relevant looking results
rangeland OR pasture or pastoralist* AND biodivers* or	903	30.4.2013	Adding ranch brings some good articles not so many

divers* or loss or deplet* or
 overgraz* or degradat* or
 conservation AND benefit* or
 sustainab* or improv* or
 effect* AND community
 managed or "community
 based" or "community
 controlled" or tenure or
 property rights or collective or
 privatization and ranch
 rangeland OR pasture or 2086 30.4.2013 seems relevant, but still not discussing
 pastoralist* AND biodivers* or environmental outcomes that much
 divers* or loss or deplet* or
 overgraz* or degradat* or
 conservation AND benefit* or
 sustainab* or improv* or
 effect* AND community based
 or collective or privatization or
 common property or tenure or
 property rights
 fish* OR forest* OR 10334 17.5.2013 cattle and livestock bring a lot of noise, maybe a
 rangeland* OR pasture OR separate search needs to be done on the
 grasslands or livestock or cattle
 AND property near (common
 or regime) or common?pool or
 community same (based or
 manage*) or privat* or state or
 compan* AND tree or wood*
 or environment* or ecologic*
 OR condition or population
 fish* OR forest* OR
 rangeland* OR pasture OR
 grasslands or livestock or cattle
 AND chang* or impact* or
 effect* or improv* or declin*
 or *crease AND tenure or
 allocation or ownership or right
 or intervention
 fish* OR forest* or marin* 2377 17.5.2013 Nice results for forests, fisheries irrelevant
 AND property same (common
 or regime) or common?pool or
 community same (based or
 manage*) or privat* or state or
 compan* AND forest or timber
 or tree or environment* or
 ecologic* OR condition or
 population or fish* or stock
 AND impact* or effect* or
 improv* or deplet* or conserv*
 or sustainab* AND tenure or
 allocation or ownership or
 intervention or quota
 fish* or marine AND 1007 20.5.2013 based on keywords for fisheries article
 customary or small?scale or

(property right*) or (common property) or tenure or (open access) AND resource* or population or size or stock or catch or specie* or biomass AND access or manag* or harvest*			
forest* AND comm?n* or community* or privat* or state or compan* or concession* or compan* or collective AND tree* or wood* or environment* or ecologic* OR condition* or biodiversity or specie* or forest* or resource AND chang* or impact* or effect* or improv* or declin* or *crease AND decentraliz* or tenure or allocation or ownership or intervention or reform or (property rights) or property regime or management	5272	20.5.2013	very good, easy to exclude with words USA, Canada, Sweden
forest* or property rights or tenure AND comm?n* or community* or privat* or state or compan* or concession* or compan* or collective AND tree* or wood* or environment* or ecologic* OR condition* or biodiversity or specie* or forest* or resource AND chang* or impact* or effect* or improv* or declin* or *crease AND decentraliz* or tenure or allocation or ownership or intervention or reform or property rights or property regime or management	5538	21.5.2013	By Excluding Canada,Sweden,Finland,Mediterranean,Australia 316+150+133+128+ 245
grassland* or pastoralist or pasture or livestock AND comm?n* or state or privat* AND property rights or tenure or property regime AD animal* or land or environment* or vegetation or composition or species	599	21.5.2013	stil not too many articles discussing environmental outcomes but common property regimes in general
forest* or fish* or marine or grassland* or pastoralis* or pasture or rangeland* AND decentraliz* or tenure or reform* or allocation or ownership or "property right"or	2650	2.9.2013	2652 all the years/2557 (1990–2013) and 1451 2008–2013. Contains reform

"property rights" or "property regime" or "property system" or manag* or access or harvest* or open?access AND collective or comm?n* or small?scale or customary or state or public or privat* or compan* or concession* or participat* or collaborative or co?operative or co-manage* or shared or joint AND Afghan* or Bangladesh* or Benin* or Burkina* or Burundi* or Cambodia* or Central African Republic or Chad* or Comoro* or Congo* or Eritrea* or Ethiopia* or Gambia* or Guinea* or Haiti* or Kenya* or Korea* or Kyrgyz* or Liberia* or Madagascar* or Malagasy* or Malawi* or Mali* or Mozambique* or Myanmar* or Burma* or Nepal* or Niger* or Rwanda* or Sierra Leone or Somali* or Sudan* or Tajikistan* or Tanzania* or Togo* or Uganda* or Zimbabwe*

forest* or fish* or marine or 7169 23.8.2013 7169 (1990–2013), 4147 (2008–2013)

grassland* or pastoralist* or pasture or rangeland AND decentraliz* or tenure or allocation or ownership or reform or (property rights) or property regime or management* AND collective or comm?n* or small?scale or customary or state or public or privat* or compan* or concession* or participat* or collaborative or cooperative or co-manage* AND Angola* or Algeria* or Samoa* or Argentina* or Azerbaijan* or Beliz* or Botswana* or Brazil* or Chin* or Colombia* or "Costa Rica" or "Costa Rican" or Cuba* or Dominica* or Equatorian* or Ecuador* or Fiji* or Gabon* or Grenad* or Iran* or Iraq* or Jamaica* or Jordan* or Kazak* or Leban* or Libya* or Malaysia* or Maldives or "Marshall Islands"

or Mayotte or Mauritius or
Mexic* or Namibia* or Palau*
or Panama* or Peru * or
Seychell* or "South Africa" or
"St. Lucia" or "St. Vincent" or
Suriname* or Thai* or Tonga*
or Tunisia* or Turk* or
Turkmenistan* or Tuvalu* or
Venezuela*

forest* or fish* or marine or
grassland* or pastoralis* or
pasture or rangeland* AND
decentraliz* or tenure or
reform* or allocation or
ownership or "property right" or
"property rights" or "property
regime" or "property system"
or manag* or access or
harvest* or open?access AND
collective or comm?n* or
small?scale or customary or
state or public or privat* or
compan* or concession* or
participat* or collaborative or
cooperative or co-manage* or
shared or joint AND Angola*
or Algeria* or Samoa* or
Argentina* or Azerbaijan* or
Beliz* or Botswana* or Brazil*
or Chin* or Colombia* or
"Costa Rica" or Cuba* or
Dominica* or Ecuador* or
Fiji* or Gabon* or Grenad* or
Iran* or Iraq* or Jamaica * or
Jordan* or Kazak* or Leban*
or Libya* or Malaysia* or
Maldives or "Marshall Islands"
or Mayotte or Mauritius or
Mexic* or Namibia* or Palau*
or Panama* or Peru* or
Seychell* or "South Africa" or
"St. Lucia" or "St. Vincent" or
Suriname* or Thai* or Tonga*
or Tunisia* or Turk* or
Tuvalu* or Venezuela*

7356 2.9.2013 7356 (1990–2013), 4241 (2008–2013). This search
contains benchmark studies identified

References

1. Hardin G: **The tragedy of the commons.** *Science* 1968, **162**:1243–1248.
2. Ostrom E: *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge: Cambridge University Press; 1990.
3. Larson AM, Soto F: **Decentralization of Natural Resource Governance Regimes.** *Annu Rev Environ Resour* 2008, **33**:213–239.
4. Ostrom E, Nagendra H: **Insights on linking forests, trees, and people from the air, on the ground, and in the laboratory.** *Proc Natl Acad Sci* 2006, **103**:19224–19231.
5. Besley T, Burgess R: **Land reform, poverty reduction, and growth:evidence from India.** *Q J Econ* 2000, **115**:389–430.
6. Meinzen-Dick RS, Brown LR, Feldstein HS, Quisumbing AR: **Gender, property rights, and natural resources.** *World Dev* 1997, **25**:1303–1315.
7. Berkes F: **Community conserved areas: policy issues in historic and contemporary context.** *Conserv Lett* 2009, **2**:19–24.
8. Sunderlin WD, Larson AM, Cronkleton P: **Forest Tenure Rights and REDD+: From Inertia to Policy Solutions.** In *Realising REDD+: National Strategy and Policy Options.* Bogor, Indonesia: Center for International Forestry Research (CIFOR); 2009:139–149.
9. Lemos MC, Agrawal A: **Environmental Governance.** *Annu Rev Environ Resour* 2006, **31**:297–325.
10. Dahal GR, Larson AM, Pacheco P: **Outcomes of Reforms for Livelihoods, Forest Condition and Equity.** In *Forests for People: Community Rights and Forest Tenure Reform.* London, UK: Earthscan; 2010:183–208.
11. Costello C, Gaines SD, Lynham J: **Can catch shares prevent fisheries collapse?** *Science* 2008, **321**:1678–1681.
12. Homewood KM: **Policy, environment and development in African rangelands.** *Environ Sci Pol* 2004, **7**:125–143.
13. Brooks J, Waylen KA, Borgerhoff Mulder M: **Assessing community-based conservation projects: A systematic review and multilevel analysis of attitudinal, behavioral, ecological, and economic outcomes.** *Environ Evid* 2013, **2**: .
14. Evans L, Cherrett N, Pemsil D: **Assessing the impact of fisheries co-management interventions in developing countries: a meta-analysis.** *J Environ Manage* 2011, **92**:1938–1949.
15. Hellebrandt D, Sikor T, Hooper L: *Rigorous Literature Review. Is the use of Renewable Natural Resources in the Developing World more or less Sustainable, Pro-Poor and*

Profitable under Controlled Access compared to Open Access. Norwich, UK: International Development UEA –DEVCo; 2012:1–98.

16. Sayer J, Sunderland T, Ghazoul J, Pfund J-L, Sheil D, Meijaard E, Venter M, Boedhihartono AK, Day M, Garcia C: **Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses**. *Proc Natl Acad Sci* 2013, **110**:8349–8356.

17. Larson AM, Barry D, Dahal GR, Colfer CJP: *Forests for People: Community Rights and Forest Tenure Reform*. London: Earthscan; 2010.

18. CEE: **Guidelines for Systematic Reviews in Environmental Management (version 4.2)**. *Collaboration Environ Evid* 2013, :1–80.

19. Schlager E, Ostrom E: **Property-Rights Regimes and Natural Resources: A Conceptual Analysis**. *Land Econ* 1992, **68**:249–262.

20. Waldron J: *The Right to Private Property*. Oxford: Clarendon Press; 1988.

21. Bromley DW: *Environment and Economy: Property Rights and Public Policy*. Oxford: Blackwell; 1991.

22. Smith EP: **BACI design**. *Encyclopedia Environ* 2006, **1**:141–148.

23. Porter-Bolland L, Ellis EA, Guariguata MR, Ruiz-Mallen I, Negrete-Yankelevich S, Reyes-Garcia V: **Community managed forests and forest protected areas: An assessment of their conservation effectiveness across the tropics**. *For Ecol Manag* 2012, **268**:6–17.

24. Robinson BE, Holland MB, Naughton-Treves L: **Does Secure Land Tenure Save Forests? A Review of the Relationship between Land Tenure and Tropical Deforestation**. In *CCAFS Working Paper*. CGIAR Research Program on Climate Change, Agriculture and Food Security; 2011.

25. Shahabuddin G, Rao M: **Do community-conserved areas effectively conserve biological diversity? Global insights and the Indian context**. *Biol Conserv* 2010, **143**:2926–2936.

26. Higgins J, Green S: *Cochrane Handbook for Systematic Reviews of Interventions*. The Cochrane Collaboration; 2008.

27. Sikor T, Lund C: **Access and property: a question of power and authority**. *Dev Chang* 2009, **40**:1–22.

28. Leimu R, Koricheva J: **What determines the citation frequency of ecological papers?** *Trends Ecol Evol* 2005, **20**:28–32.

29. Sterne JA, Egger M: **Funnel plots for detecting bias in meta-analysis: guidelines on choice of axis**. *J Clin Epidemiol* 2001, **54**:1046–1055.

30. **Terms and Definitions-Global Forest Resources Assessment.**
[<http://www.fao.org/docrep/006/ad665e/ad665e06.htm>].
31. **Fisheries Glossary online.** [<http://www.fao.org/fi/glossary/>].
32. **Glossary of Terms used in Range Management.**
[<https://globalrangelands.org/rangelandswest/glossary>].
33. Bromley DW, Cernea MM: **The Management of Common Property Natural Resources: Some Conceptual and Operational Fallacies.** Volume 57. World Bank Discussion Papers; 1989.
34. Macpherson CB: **Property, Mainstream and Critical Positions.** Toronto, Canada: University of Toronto Press; 1978.
35. Eggertsson T: *Economic Behavior and Institutions.* Cambridge, U.K.: Cambridge University Press; 1990.
36. Honore AM: **Ownership.** Oxford: Oxford University Press; 1961.
37. **World Bank Country Classifications.** 2013.
38. **Timeline of Country and Capital Changes.**
[http://en.wikipedia.org/wiki/Timeline_of_country_and_capital_changes].

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