

Regulation, the Hybrid Market, and Species Conservation – The Case of Conservation Banking in California

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Research Article

Keywords: conservation banking, offsets, habitat banking, social-ecological fit, instrument interaction, endangered species act

Posted Date: May 9th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1619303/v1>

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Version of Record: A version of this preprint was published at Ambio on November 2nd, 2022. See the published version at <https://doi.org/10.1007/s13280-022-01803-2>.

Abstract

Conservation Banking in California is a long-established offset program. Banks are hybrid instruments that hover between market autonomy and regulatory oversight. Challenges that may affect program success include aligning regulation with the scales and objectives of the hybrid market and conservation and interaction with other compensation instruments. I use an analytical framework combining social-ecological fit (does the regulation fit the spatial, functional, and temporal scales of the market or conservation?) and instrument interaction (are compensation instruments redundant, synergetic, etc.?) to analyze the institutional framework of the conservation banking program. Results show that the program fails to reflect the hybrid market or species conservation objectives, creating a social-ecological mismatch. The institutional framework disincentivizes banking, while its success in conserving species cannot be measured. Competing and redundant instruments can lead to weaker compensation. The program needs equal standards that reflect conservation objectives for all compensation instruments. Findings on fit can be useful for other banking programs, and considerations on instrument interaction could improve offsets anywhere.

Introduction

For decades, governments have made an effort to reduce global biodiversity loss. These efforts include the prohibition of specific impacts and the development of offset programs (Hrabanski 2015). Offsets are ‘measurable conservation outcomes’ implemented to compensate for unavoidable adverse impacts of development projects to at least maintain the current status of biodiversity (BBOP 2012). They exist in over 100 countries (Maron et al. 2018; Bull et al. 2020). However, questions concerning the proper implementation of offsets and their success in conserving nature remain (Yu et al. 2022).

The California conservation banking program was one of the first offset programs for impacts on species and habitats. A conservation bank conserves and manages protected species habitat for which they receive credits from the permitting agencies. A project developer who needs to compensate for unavoidable impacts to such species can then purchase these credits. Banks are strictly regulated, and many stakeholders agree that the program holds ecological and economic benefits (Grimm 2020). Researchers and agencies have studied program design or the ecological contribution of individual banks (Bunn et al. 2014; Carreras Gamarra and Toombs 2017; Sonter et al. 2019; Grimm 2021), but due to limited tracking and data on species ecology, none have evaluated its actual success in conserving species. However, scholars agree that the institutional setting, including legislation and market arrangements, affects offsets’ effectiveness (Boisvert 2015; Gelcich et al. 2016; Sonter et al. 2020; White et al. 2021).

The main challenges of conservation banking (CB) include a lack of standards and competition with other market-based compensation instruments (White et al. 2021). This raises the “problem of governance” (p. 362), which is rooted in the difficulty of fitting scales of ecological processes with scales of market activity and regulation (Robertson 2004). van Teeffelen et al. (2014) analyze economic and

ecological prerequisites for a successful CB program and show that the two differ in terms of objectives, requiring trade-offs. The challenge lies in bridging these spheres to allow for trading “environmental intangibles” (Barral 2020; Chiapello and Engels 2021) in a market restricted by regulation. Previous research has discussed this hybridity of banking instruments (Vaissière and Levrel 2015; Rea 2017) and the mismatch of economic and ecological objectives (Calvet et al. 2015b). I analyze the interaction of the regulatory, hybrid market and ecological sphere from a social-ecological systems perspective, including the relation of banks to other compensation instruments.

Conservation banking takes place in a social-ecological system (SES) (Mann and Absher 2014; White et al. 2021). An SES perspective allows for a systemic view of the regulatory, ecological, and market sphere. Previous research has also focused on matching institutional settings to the systems they organize (Folke et al. 2007; Mann and Absher 2014). Because most research combining SES and offsets has focused on stakeholders and their values, Gelcich et al. (2016) advocate analyzing the institutional settings for offset programs to better understand institutional differences and enabling conditions. Banking takes place in a hybrid regulatory market, where credit demand is created by the developer’s responsibility to compensate for unavoidable impacts. This article aims to fill the research gap on such hybrid governance identified by Baker et al. (2020) and adds to a better understanding of institutional settings in SES (Guerrero and Wilson 2017). CB in California is a long-established program, and an analysis of its institutional framework can provide insight into the challenges and practicalities for banking approaches developed elsewhere (e.g., the Netherlands, Spain; (cf. Gorissen et al. 2020; Maestre-Andrés et al. 2020).

Materials And Methods

California conservation banking

Conservation banking originated in California in the early 1990s, and most banks (126 out of 194) are located in the state (RIBITS 2021). CB is rooted in state and federal legislation: The California Endangered Species Act (CESA) and the US Endangered Species Act (ESA). The ESA prohibits the “take[1]” of threatened and endangered species. When a project impacts such species or their habitat, the developer may need to compensate for unavoidable impacts by conserving, enhancing or restoring habitat elsewhere. Developers may use different instruments to fulfill this compensation requirement: The developer can implement compensation themselves (permittee-responsible mitigation, PRM) or go through a third party. Third-party compensation (Table 1) includes CBs, in-lieu fees (ILF), habitat credit exchanges (HCEs), turnkey mitigation projects, paying a fee to a Regional Habitat Conservation Plan (RHCP)/ Natural Community Conservation Plan (NCCP) administration, or going through a mitigation credit agreement (MCA).

Table 1 Compensation instruments in California

Compensation Instrument	Description	Jurisdiction	Compensation Attributes		
			Advance	Consolidated	Strategically sited
			x	x	(x)
Conservation Bank (CB)	A site of listed species habitat that is conserved and managed by a 'bank sponsor' (often private entities) to generate credits. Credits are approved by regulating agencies and can then be purchased by a developer.	Federal & State	-	-	-
Permittee-Responsible Mitigation (PRM)	Project-by-project compensation implemented by the developer. No credits generated.	Federal & State	(x)	-	-
Turnkey Mitigation	Like PRM, but a banking company or consultancy implements the project-specific mitigation for the developer.	Federal & State	x	(x)	-
Habitat Credit Exchange (HCE)	Multiple landowners generate credits by conserving, creating and managing habitat. These diffuse credits are organized and sold to developers through a central clearinghouse.	Federal	x	(x)	-
In-Lieu Fee (ILF)	A program (often run by public actors) collecting funds from developers to conserve and manage habitat sites for mitigation. Credits are approved by agencies and sold to the developer, but conservation is implemented incrementally based on sales.	Federal	-	x	(x)
Regional	Regional conservation	Federal	(x)	x	x

Habitat Conservation Plan (RHCP)	strategy planning for development and compensation implemented by one or multiple agencies. Some implement compensation by collecting a fee (ILF program).				
Natural Community Conservation Plan (NCCP)	Like an HCP, but under state jurisdiction.	State	(x)	x	x
Regional Conservation Investment Strategy (RCIS)	Similar to an RHCP/NCCP, but non-binding. Conservation actions may provide advance mitigation through the implementation of an MCA (see below).	State	Not applicable - see MCA		
Mitigation Credit Agreement (MCA)	Conservation or enhancement actions identified in an RCIS implemented to generate credits for mitigation.	State	x	?	x

A CB is a site where a third party conserves and manages protected species habitat for which they receive credits from the permitting agencies. By providing compensation measures, banking is intended to contribute to species conservation. By definition, a CB is established before the impact occurs, and the site consolidates multiple compensation requirements. Credits can only be sold in-kind (for the same species or habitat) and for impacts taking place within a designated service area (impacts for which mitigation credits are purchased must be located in this geographic area). This limits the distance from the impact to the compensation site and provides a functional relation. When bank sites include wetlands, they can also produce wetland credits to compensate for impacts under the Federal Clean Water Act. In that case, the US Army Corps of Engineers is involved in the approval process. To streamline the approval process for such multi-credit banks, the agencies signed a Memorandum of Understanding (MOU) in 2011, which provides the basis of bank approval and oversight in California (CNRA, CDFW, et al. 2011).

Policy instruments are often categorized as either legal, voluntary or economic (Blackstock et al. 2021). However, instruments can also be hybrids, combining state and non-state actors (Vatn 2015, 2018; Ghosh and Wolf 2021). Banking approaches are not market-based instruments, but regulation-based hybrid regulatory markets (Boisvert 2015; Vaissière and Levrel 2015; Koh et al. 2019) or “command-and-commodify” instruments (Rea 2017): Demand and supply only exist because legislation requires

developers to compensate and regulatory oversee both supply and demand. Thus, the institutional framework has developed from regulating impacts to also regulating a market with different compensation instruments and suppliers, requiring a balancing act between ecological and market spheres.

Aim and methods

This article analyzes the institutional setting of CB in California and draws conclusions regarding the success and the future of the program. I examine a regulation torn between serving a hybrid market and species conservation as well as interactions between different compensation instruments. The questions to be answered are:

- Do conservation banking regulations and standards reflect the scales (spatial, temporal, functional) and objectives of the hybrid market or species conservation?
- How do different compensation instruments interact? What is the current level of standardization?
- What does that mean for the success and future of the program?

This research draws on environmental governance literature in the context of SES to provide a conceptual understanding of institutional settings in SES and establish a framework for the analysis of the CB program. I conducted a configurative review (Gough et al. 2012) of journal articles published 2000 – 2021 in Scopus (searching for “social-ecological systems” in combination with “offset”, “conservation banking”, “banking”, “environmental governance”, “market-based”), followed by a review of titles and abstracts and a snowball approach. I then selected the theoretical framework outlined in Ch. 3 (instrument interaction, social-ecological fit) as a framework for the analysis of the conservation banking program.

To apply this framework, I use information on CB gathered through 30 semi-structured qualitative interviews conducted in California in 2019. The interviewees (Appendix I) were agency staff (n=12), bank sponsors (n=11), consultants (n=10), and others (attorneys, NGOs, permittees, researchers, n=4). The interviews were coded deductively and iteratively (Mayring 2014). In addition, data was gathered from literature on CB and from policy and guidance documents. This combination of data allows for analyzing legal requirements and implementation in practice (Paavola et al. 2009).

[1] “To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect a federally listed species, [...]” (16 U.S.C. 1532(19)).

Theoretical Framework For Analysis

SES are integrated systems of humans and the environment with interdependent linkages (Berkes 2017; Partelow 2018). This chapter provides a conceptual understanding of institutional settings in SES and a framework for the analysis of conservation banking.

3.1. Social-ecological fit

Social-ecological fit refers to the idea that effective institutions ‘match’ the characteristics of the SES (Young 2002; Folke et al. 2007). Institutions are „sets of rules, decision-making procedures, and programs that define social practices, assign roles to the participants in these practices, and guide interactions among the occupants of individual roles” (Young 2002, p.5). Problems of fit occur when institutions fail to adequately address components or links of the ecological systems they govern (e.g., stressors affecting species survival) (Ekstrom and Young 2009). Fit can refer to political, economic and ecological dimensions (Guerrero et al. 2021). Fit is discussed often in the context of social-ecological systems (Folke et al. 2007; Ekstrom and Young 2009; Epstein et al. 2015) and conservation approaches (Guerrero and Wilson 2017; Guerrero et al. 2021).

The fit of hybrid instruments with regulations, ecological systems and relevant objectives (such as species conservation) is crucial for designing effective institutions in SES (Cash et al. 2006). Mann and Absher (2014) discuss fit and interplay when analyzing stakeholder negotiations during the establishment of the conservation banking program. I build on their work, using three dimensions of fit for a qualitative analysis of how the regulatory sphere of CB aligns with the scales and objectives of the hybrid market and species conservation:

- Functional fit: “How well institutions address the relevant biophysical and social-ecological functions and processes in the system being managed” (Guerrero et al. 2021, p.2).
- Spatial fit: How well the boundaries of ecological processes and institutional management coincide (Paavola et al. 2009; Vatn and Vedeld 2012).
- Temporal fit: How well institutions reflect time spans in the ecological sphere and the time frame in which the institutional setting can respond to environmental changes (Vatn and Vedeld 2012; Mann and Absher 2014).

Instrument interaction

Institutions are „sets of rules, decision-making procedures, and programs that define social practices, assign roles to the participants in these practices, and guide interactions among the occupants of individual roles” (Young 2002, p.5). They function as rules of interactions in SES (Werdiningtyas et al. 2020), and the interactions of institutions with other institutions can affect the effectiveness of environmental governance of SES (Young 2002). Policy instruments (such as CBs) are a form of institutions (Corbera and Brown 2008; Mann and Absher 2014). Instruments interact with other instruments and abide by the context conditions of the institutional framework (Werdiningtyas et al. 2020). Understanding how instruments interact can help align these instruments with their objectives and

may lead to effective policy solutions in SES (IPBES 2019). To analyze the relationship between CBs and other compensatory mitigation instruments, I use the five categories provided by Santos et al. (2015) (Table 2).

Table 2
Categories of instrument interaction (Santos et al. 2015)

Category	Definition
path dependency, sequential interaction	one follows another “in a temporal sequence”
complimentary	one is added to improve the performance of another
synergy	positively reinforcing one another
redundancy, overlap	addressing the same goal, potentially lowering performance
conflict	interact negatively, lowering performance

Results

This chapter explores compromises and mismatches between the regulatory framework and the scales and objectives of the market and species conservation. It discusses the standardization and interaction of different compensation instruments. Figure 2 shows the structure of the program, including federal and state legislation, actors, supply and demand.

Figure 2 The California conservation banking program: Institutional framework. The left shows the legislation and regulatory agencies, the top right shows the impact permitting process, and the bottom right the bank approval process and other compensation instruments.

Regulation, the hybrid market, and species conservation

Conservation banking regulation must combine scales and objectives of the hybrid market and species conservation: “Banking provides an opportunity to soften impact of command and control while still protecting listed species” (FWS 5). As hybrid instruments, banks hover between a certain degree of market autonomy (e.g., market-influences credit pricing) and regulatory oversight (e.g., requirements for bank establishment). They compensate for impacts on species and habitat and thus contribute to conservation. Vaissière et al. (2017) describe how negotiations between wetland mitigation bankers and regulators keep the program in a “zone of ecological-economic viability” (p.512). The CB approval process in California is a template-based negotiation as well (Grimm 2020), where stakeholders must balance the implementation of regulatory requirements with ecological and market objectives. This section analyzes temporal, spatial and functional fit of the hybrid market, species conservation and the regulatory framework. I argue that the regulatory framework and existing standards of the conservation

banking program in California fail to fit the hybrid market or species conservation, creating a social-ecological mismatch.

Spatial considerations

Conservation bankers rely on sufficient credit demand (unavoidable impacts caused by development) for profit (van Teeffelen et al. 2014). Demand is determined by species occurrence and impacts located within the service area of the bank. This potential demand is considered by bankers when selecting a site, which in turn affects how well bank site and service area fit the spatial dynamics of species conservation.

The bank site is selected by bankers and approved by the agency (FWS 5, Cons. 21, CDFW 10). Bankers and agencies should consider area size, short habitat restoration time (van Teeffelen et al. 2014), connectivity (ibid., Cons. 23, CDFW 12, Bank 15, 17, 18) and existing plans, such as species recovery plans (describe the status, threats and objectives for protected species) (FWS 3, 4, CDFW 10, 12, Bank 17, 18). In practice, site selection is based on expected credit demand, suitability for species habitat or occupancy (Bank 17, FWS 4, Cons. 21) and adjacent land use (CDFW 12, Bank 17). Although guidance includes other habitat and landscape values (CDFW 2019a), agencies often accept any suitable habitat (FWS 5, CDFW 11). Bankers select regions where they expect credit demand (FWS 3, Cons. 20), which occurs in large urban areas (Poudel et al. 2019). Therefore, some suitable sites do not become banks, because of low feasibility (Cons. 20, CDFW 11). Selected regions are often densely developed, making land availability and cost critical for site selection (Poudel et al. 2018; Poudel and Pokharel 2021).

At the other extreme are areas where no banks exist due to little demand (e.g., Northern California) (CDFW 11, Cons. 21). In such regions, it may be more difficult for developers to mitigate (CDFW 9): They must use other compensation instruments that may not be implemented in advance or may not consolidate multiple compensation requirements in a large area, providing potentially weaker compensation. Also, many species aren't covered by banks (e.g., San Joaquin Antelope Squirrel, *ammospermophilus nelsoni*), and permittees cannot find suitable sites for PRM (CDFW 11). This creates a potential functional mismatch between the ecological objectives (by providing the best compensation options) and hybrid market dynamics.

Concerning the service area, ecological and economic interests differ. Bankers prefer a large service area, and agencies prefer a smaller one to limit the geographic distance between impact and compensation site (Attorney 14, CDFW 10, FWS 4, 5). Still, the negotiations between bankers and agencies lead to a compromise between incentivizing markets and reflecting species conservation (leaning more towards the latter): The service area is usually based on species recovery plans (CDFW 11, 12, Attorney 14, Bank 17, Cons. 21). They reflect the objective of species recovery (CDFW 12, Cons. 28) and allow bank feasibility (CDFW 11, 12, Attorney 14, Bank 17, FWS 5). However, if there is no other option, a developer outside of a service area may also purchase bank credits (CDFW 12, Bank 17, Cons. 28, FWS 3, County 2). Such cases increase demand for bankers but may fail to spatially and functionally fit the ecological objectives. Bank feasibility and availability are also affected by bank approval and crediting requirements, which I outline in the following section.

Temporal and functional considerations

Many stakeholders suggested that the requirements for bank approval need improvement, because it has become expensive and difficult (Bank 17, 18, Attorney 14, Cons. 20, 24, FWS 5). Agencies increased procedural requirements to reduce the risk of bank failure by holding banks to higher standards, disincentivizing habitat protection through banks (FWS 3, Cons. 20, 22, 24, 26). The approval process takes 1.5-2 years on average (CDFW 11, Bank 16, Attorney 14) and can be affected by jurisdictional conflicts (Cons. 20, 25, County 2). Progress was made with the MOU between agencies (CDFW 10, 11, Cons. 21), but preferences concerning details of bank approval vary between agencies, offices and individuals (Cons. 20, 24, 27, Bank 15, 16, 18, USACE 6, CDFW 12). Bankers provide an endowment fund (700 000–1.5 million USD, funded incrementally; Bank 16, 17, Cons. 21, 28), pay fees, purchase property, put an easement in place (CDFW 11, 12) and implement long-term management and monitoring (CDFW 2019b; CNRA, CDFW, USACE, FWS 2021b). Bankers may also need to make yearly payments to investors (Bank 16) as they can be funded by capital investments (Cons. 28). Stakeholders estimate an initial investment of at least 500 000 USD (CDFW 11, Bank 15). Thus, requirements focus mostly on financial security, not on ensuring functional fit with conservation objectives.

The program thus moves away from the premise of CB to target „land rich, cash poor“ individuals to conserve species and moves towards banking businesses (CDFW 11, FWS 5, Cons. 21, 22). However, cash-poor landowners can partner with companies to establish a bank, providing the land while the company absorbs most of the financial risk and profits are split accordingly (Cons. 28, Bank 17). Still, bank feasibility is tied to how fast and at what price credits are sold. Sales and prices are based on demand and initial costs (Bank 17, Cons. 21, 25). Banks try to produce wetland and species credits to increase potential credit sales, but involving more agencies may prolong the approval process and thus increase initial costs (FWS 4). Return percentages can vary wildly (1.5%-10%, Bank 16; 4% according to Poudel et al. 2021). Poudel and Pokharel (2021) found that although the annual average operating cost for a bank (\$42.78/acre) is much lower than the revenue from credit sales (\$6014.72/acre), only 14 out of 26 banks have produced a positive return. According to two banking companies (16, 18), it takes about three years to make a profit. A bank site must cover at least 50 acres to make the approval process worth it, disincentivizing the protection of smaller areas (Cons. 27). Here, synergies between the market and the ecological objectives can be observed in terms of area size: Both bankers and species benefit from larger sites (van Teeffelen et al. 2014).

The credits and methods that are used to define the units bought and sold “allow the assessment of habitat recovery [and] they are the cornerstone of conservation banking profitability” (Barral 2019). Crediting should therefore fit different temporal scales and functional linkages. However, the conservation banking program is struggling with some mismatches between crediting and conservation outcomes:

- Whereas the land is protected and the easement is signed in advance of the impacts, credits can be sold without ensuring an additional conservation outcome besides habitat protection (Cons. 21, 28, Bank 17, Bank/Perm. 19). Generally, banks still provide advance mitigation (Attorney 14, CDFW 11,

Cons. 20) because there is no time lag between the impact and the site protection. However, credit release is usually based on financial securities rather than outcome-based criteria (factors improving species conservation status). Therefore, a credit does not reflect a particular conservation benefit. Still, limited „ecological flexibility“ (Ermgassen et al. 2020) through in-kind credits and additional approval of the purchase by the agencies (CDFW 11, Cons. 21, CDFW 10, 11, FWS 5) ensure a limited functional link.

- Crediting is based on habitat acreage, not ecological quality (Grimm 2021). An explicit goal of no net loss or a net gain referring to species recovery and reflecting that goal in the crediting could improve functional fit because a threat to recovery might be something other than habitat loss (FWS 5, Cons. 28). Although practitioners agree that banks provide higher quality habitat than the impacted area (Grimm 2020), the program cannot ensure or measure additional conservation outcomes from banking. Therefore, due to poor tracking and transparency and no functional methods for assessing losses and gains (CDFW 10, 12, Cons. 20, 28), crediting does not match the ecological objectives. Banks provide a baseline and conduct annual reports and long-term monitoring (Bank 17,18, Bank/Perm. 19, Cons. 21, 28, FWS 3, (CNRA, CDFW, USACE, FWS 2021a)), which could be used for crediting purposes to align measurement of losses and gains with regulatory conservation objectives.

Figure 2 summarizes the regulatory framework's temporal, spatial, and functional fit with the hybrid market and species conservation. Regulating the approval process is easier than focusing on conservation outcomes (Cons. 27), but the requirements disincentivize bank establishment without enforcing ecological objectives and create a social-ecological mismatch. They also have led to mitigation companies providing potentially weaker compensation projects. This interplay between banks and other compensation instruments is explored in the next section.

Instrument interaction and standardization

The relevant regulations do not only rely on banks to compensate for impacts but also on other types of compensation instruments (ILF, etc.). These instruments function on different jurisdictional scales (e.g., federal and state regulations, county plans and project-by-project compensation). This chapter outlines differences and similarities among compensation instruments and discusses their relation to banks (Table 3). Due to redundant and competing instruments, there is a problem with interplay between different compensation instruments applied under ESA/CESA.

Banks and Regional Conservation Plans

ESA/CESA allow the establishment of Regional Habitat Conservation Plans (RHCPs, federal jurisdiction) and Natural Community Conservation Plans (NCCPs, state jurisdiction). These plans provide a regional strategic framework for impacts and the protection of species and habitat through mitigation: They anticipate certain impacts for multiple decades and receive an umbrella impact permit for such, which is tied to the implementation of a conservation strategy as mitigation (FWS 2014; CDFW and FWS 2015).

Banks and RHCPs/NCCPs were intended to be complementary (CDFW 2014): Banking was created as a tool for implementing the associated compensation measures and the plan as a framework for directing mitigation efforts (CDFW 10, Attorney 14, Mann and Absher 2014). The plans would ensure that banks are located in ecologically valuable areas and ensure the achievement of ecological objectives through automatic social-ecological fit (Mann and Absher 2014). For example, Sacramento and Placer County HCPs have arrangements with banking companies to implement their mitigation strategy, creating credit demand (Attorney 14, FWS 5). Banks can also work within/around an RHCP by providing mitigation for actions not covered by the plan (Cons. 21, 24, (CDFW 2014)).

However, in other regions, spatial, temporal, and functional misfit hinders a synergetic relationship between banks and RHCPs/NCCPs. Here I explore issues of spatial, temporal and functional fit that hinder a synergetic or complementary relationship between banks and RHCPs/NCCPs:

- RHCPs/NCCPs don't exist in all regions, and bank location depends on demand and ecological suitability. Second, spatial boundaries do not align: The service area does not 100% overlap with an RHCP area, which is limited by administrative boundaries. The entire county is often smaller than the service area (Bank 17, Cons. 21, 28). It may not align with recovery areas outlined in species recovery plans, disturbing spatial/functional fit.
- Including banks outside the administrative region could interfere with the conservation strategy of an RHCP/NCCP (Cons. 24) because they include impact permits and mitigation for certain actions.
- The temporal scales may not align: RHCPs/NCCPs take years to approve and anticipate impacts and conservation for decades, and banks work with shorter time frames for quicker returns (Cons. 24, CDFW 11).

Therefore, many existing plans now implement their own compensation measures for a fee from the developer (HCP 8, Attorney 14). Some RHCPs/NCCPs have absorbed banks in their plan area and do not allow new banks (Cons. 28, HCP 8), because "there is potential competition between HCPs and banks" (Academia 1). Often, when an RHCP exists, developers must go through it (HCP 7) to get a permit for certain actions. They also make mitigation easier for the developer than getting impact permits on their own and then using a bank because the RHCP fee includes the impact permit and mitigation for multiple legislations (Cons. 20, 24, HCP 7, 8). Because the plans are run by government agencies (providing an indirect form of subsidy), they can provide mitigation at a lower cost (Attorney 14, Cons. 20, CDFW 13). This aspect of competition is further explored in the following subchapter.

Interaction with other compensation instruments

Outside of such regional plans, banks potentially compete with PRM and ILFs (mainly applied for impacts under the Clean Water Act) and HCEs (mostly pilot projects). Although all instruments provide compensation, no equal standards exist. White et al. (2021) found that stakeholders perceive that banks are held to higher standards, and with no preference for CBs, agencies allow "it to be undercut by other mitigation mechanisms perceived as less stringent" (p.9).

There are multiple reasons for the potentially unfair competition that leads to decreased bank credit demand. One is the differences in approval processes. For example, doing advance PRM is a “less intense process” than bank approval (Perm./Agency 30, Attorney 14, Cons. 20), and thus companies rather implement larger PRM projects for developers (turnkey mitigation) (Cons. 28, Bank 18). Turnkey mitigation does not consolidate multiple compensation requirements and requires less initial investment (Bank 15, CDFW 12, Attorney 14). It can also provide advance mitigation for large-scale impacts (Cons. 24) but is often developed parallel to the impact permit (Cons. 28). The cost depends on the project's risks and whether the turnkey provider takes over long-term responsibility (Cons. 24, 28). Other mitigation options can also be cheaper than bank credits: ILF credit prices can be 1/2 or even 1/3 of bank credits (Bank 16).

Rare competitors are HCEs under ESA. In these hybrid markets, multiple landowners generate credits and a central clearinghouse organizes this diffuse (sometimes temporary) credit production and the sales (Galik et al. 2017; Davis et al. 2021). HCEs are mainly in pilot stages at this point and may exist in areas with no mandatory mitigation policy (*ibid.*). In recent years, CDFW has also established a new program under CESA: Regional Conservation Investment Strategies (RCIS) provide a non-binding version of an RHCP, and six have been approved (CDFW 2018, 2019c, 2021b). RCIS are mostly proposed by public agencies (Attorney 14) and don't include a take permit (CDFW 13). Mitigation Credit Agreements (MCAs) implement compensatory mitigation within these plans (Attorney 14, CDFW 13). “RCIS and MCA, in essence, compete with banks” (Bank 15) but follow different standards than CBs: “MCA is easier and cheaper than banking” (CDFW 13). Both bank and MCA approval require the payment of a fee with CDFW (CDFW 2021a), but MCAs can be established on private or public lands (CDFW 13) and banks only on private land. MCA requirements should be similar to bank requirements to level the playing field (Cons. 23).

Many compensation instruments are redundant, but lower standards lead to unfair competition and potentially weaker compensation (Table 3). This causes them to conflict with banks and potentially lowers program performance due to weaker compensation. This competition combined with high investment costs can lead to fewer banks being established, further reducing compensation performance. Stakeholders find that PRM is the least efficient, followed by ILF programs (Attorney 14, Cons. 20, FWS 5). Therefore, banking (FWS 3, 4, CDFW 10, 12, Cons 28) or HCPs/NCCPs (Bank/Perm. 19, Cons. 24) should be the preferred options. However, such a preference may also blind regulators for great PRM options (USACE 6, Cons. 25). Uniform standards for all compensation instruments would create a level playing field (Cons. 20) with fairly competing instruments.

Table 3

Relation of other compensation instruments to conservation banks and requirements for establishment
(based on guidance documents)

Compensation instrument	Relation to banks	Requirements for compensation approval
Conservation Bank (CB)	-	<ul style="list-style-type: none"> - Prospectus - Enabling instrument² - Endowment fund - Conservation easement - Long-term management plan - Fee for review and approval (CDFW)
Permittee-Responsible Mitigation (PRM)	Redundant or conflicting	not standardized
Turnkey Mitigation	Redundant or conflicting	not standardized
Habitat Credit Exchange (HCE)	Redundant or complementary, because they target smaller areas and other landowners	not standardized, few pilot programs
In-Lieu Fee (ILF)	Redundant or conflicting	<ul style="list-style-type: none"> - Enabling instrument - Conservation easement - Long-term management plan (some standardization due to MOU)
Regional Habitat Conservation Plan (RHCP)	Complementary, synergistic or redundant (depending on region)	<ul style="list-style-type: none"> - HCP document with impact assessment and conservation strategy - Conservation easements or other means of protection - Endowment fund or other financing approach

² Application document incl. purpose, baseline conditions, bank evaluation and development, endowment fund, credit release, service area, interim management, reporting

³ Application document incl. purpose and need, service area, site evaluation and development, financial assurances, credit release schedule, management and operations, etc.

Compensation instrument	Relation to banks	Requirements for compensation approval
Natural	As above	- Planning Agreement
Community Conservation Plan (NCCP)		- Potentially conservation easements or other means of protection
Regional Conservation Investment Strategy (RCIS)	Complementary, synergetic or conflicting	- Plan document - Fee for review and approval (CDFW) - see MCA
Mitigation Credit Agreement (MCA)	Redundant or conflicting	- Location within RCIS - MCA Template ³ - Conservation Easement - Endowment fund - Fee for approval (CDFW)

² Application document incl. purpose, baseline conditions, bank evaluation and development, endowment fund, credit release, service area, interim management, reporting

³ Application document incl. purpose and need, service area, site evaluation and development, financial assurances, credit release schedule, management and operations, etc.

Discussion: Implications For The Success And Future Of The Program Social-ecological (mis)fit?

Results show that the regulatory framework and standards of the CB program in California hover between the objectives of the market and species conservation. Banking is a hybrid instrument because ecological processes cannot be fully commodified for the economic sphere, and the market is restricted by regulation. Credit demand strongly affects bank feasibility, and the implementation of the banking program affects species recovery. Market and ecological objectives are affected by

- spatial (service area, market size, bank site and size),
- temporal (advance mitigation, duration of approval processes, perpetual management), and
- functional (crediting, equivalence) considerations.

Scholars have called for implementing better offset protocols that align with conservation objectives (Watson et al. 2021). Results show the complexity of the institutional arrangements of CB, and highlight that there is not a single correct characterization of scale to be targeted by governance instruments (Cash

et al. 2006; Folke et al. 2007). For some aspects, market and ecological objectives favor different levels on a temporal and spatial scale and will always lead to trade-offs. For example, the more ecologically complex crediting methods are, the lower the tradability in a market (Calvet et al. 2015b). Such trade-offs can also affect public accountability (Barral 2019) and program oversight.

Regulators aim to solve such trade-offs by hovering between command and control nature conservation (strictly prohibiting certain actions) and a market. In some cases, they manage a compromise (e.g., service area based on recovery plans), while other requirements are closer to reflecting ecological objectives (in-kind credits) or market objectives (credits based on acreage) and some benefit neither (e.g., lengthy approval processes). The technical challenges of offsets (e.g., crediting and equivalence) (Calvet et al. 2015b; Chiapello and Engels 2021) reflect the challenge of aligning economic and ecological spheres and are symptoms of problems of fit. For example, the only factor affecting species recovery considered in the program is habitat loss. However, an institutional framework should encompass all essential ecosystem functions and properties (Ekstrom and Young 2009; Paavola et al. 2009), and other factors do affect species conservation. Offsets should apply at least a functional (accounting for functions of ecosystems and species) or even a systemic accounting approach (accounting for biodiversity dynamics, processes and interactions) (Calvet et al. 2015b). Current standards focus on procedural and financial aspects, which does not benefit the banking market nor measure banks' contribution to species conservation. Therefore, the banking program should reduce procedural/financial safeguards (FWS 3, Cons. 26) and move towards more functional accounting to align implementation with ecological objectives.

Instrument interaction and program performance

Federal and state regulations pursue different goals and create different instruments that overlap. Some of these instruments function at a regional scale, while others function at a more local scale and the spatial boundaries of each are not often congruent. The conservation banking program overlaps with other compensation instruments, which can increase cost-effectiveness and flexibility (Santos et al. 2015), assuming that all redundant instruments lead to the same conservation outcomes. A strong policy mix "builds on the strengths of individual instruments, while compensating for their weaknesses with additional or complementary instruments, thereby maximizing overall policy performance" (*ibid.*, p. 295).

Currently, instrument interaction is mainly redundant, with unfair competition causing conflicts. Although RHCPs/NCCPs in synergy with banks could create larger connected areas over time (Bank/Perm. 19, Attorney 14, Cons. 24, 28), they often compete due to different temporal and spatial scales. Without equal requirements for all compensation projects, banking might be disincentivized. Other compensation instruments may offer lower prices but don't necessarily provide compensation that is consolidated, strategically sited and implemented in advance of impacts. A shift towards weaker compensation instruments can reduce the relatively small CB market and adversely affect compensation performance under ESA. Also, private-sector compensation reflects the true environmental cost of an impact (Cons.

20). As long as requirements are not uniform, a preference for banks and HCPs/NCCPs could improve program performance (Bank/Perm. 19, Cons. 24). Policies that would have established consistent standards and a net gain goal under ESA, requiring compensation across the US (US FWS 2016), were rescinded before they were even fully implemented. Uniform requirements could allow for fair competition between overlapping and complementary instruments: Holding all instruments to the same high standards (such as advance mitigation or other quality assurances) could improve conservation outcomes.

Conclusion

Analyzing social-ecological fit in terms of temporal, spatial and functional scales has shown that the conservation banking program has found some compromises between market and ecological spheres. Results also include mismatches that could be targeted for program improvement. The analysis of instrument interaction has identified differences in requirements that cause unfair competition and weaker conservation outcomes. Moving forward, the program needs clear federal policies with equal standards for all compensation tools to stabilize the hybrid market and create synergies among compensation instruments. Such standards must be adjusted to the ecological objectives of the program to measure its contribution to species conservation. The findings on spatial and temporal scales and functional linkages could be useful for other species and habitat banking programs, and considerations on instrument interaction could help improve regulation-based offset programs anywhere.

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Appendix I: Interview Partners

No.	Stakeholder Type	In-Text Reference
1	Academia (University of California)	Academia 1
2	Agency, County Planning	County 2
3	Agency, Federal (FWS)	FWS 3
4	Agency, Federal (FWS)	FWS 4
5	Agency, Federal (FWS)	FWS 5
6	Agency, Federal (USACE)	USACE 6
7	Agency, Habitat Conservation Plan	HCP 7
8	Agency, Habitat Conservation Plan	HCP 8
9	Agency, State (CDFW)	CDFW 9
10	Agency, State (CDFW)	CDFW 10
11	Agency, State (CDFW)	CDFW 11
12	Agency, State (CDFW)	CDFW 12
13	Agency, State (CDFW)	CDFW 13
14	Attorney	Attorney 14
15	Bank Sponsor	Bank 15
16	Bank Sponsor	Bank 16
17	Bank Sponsor	Bank 17
18	Bank Sponsor	Bank 18
19	Bank Sponsor, Permittee	Bank/Perm. 19
20	Consultancy (impact and banking)	Cons. 20
21	Consultancy (impact and banking)	Cons. 21
22	Consultancy (banking)	Cons.22
23	Consultancy (biologist, impact and banking)	Cons. 23
24	Consultancy (impact)	Cons. 24
25	Consultancy (impact)	Cons. 25
26	Consultancy (impact)	Cons. 26
27	Consultancy (impact and banking, broker)	Cons. 27
28	Consultancy (impact and banking)	Cons. 28

No.	Stakeholder Type	In-Text Reference
29	NGO	NGO 29
30	Permittee, Agency, County	Perm./Agency 30

Declarations

Acknowledgements

I'd like to thank my advisors Johann Köppel and Morgan Robertson for their valuable feedback and support.

All participants agreed to be interviewed for research and for the research to be published. The author has no conflicts of interests to declare.

Figures

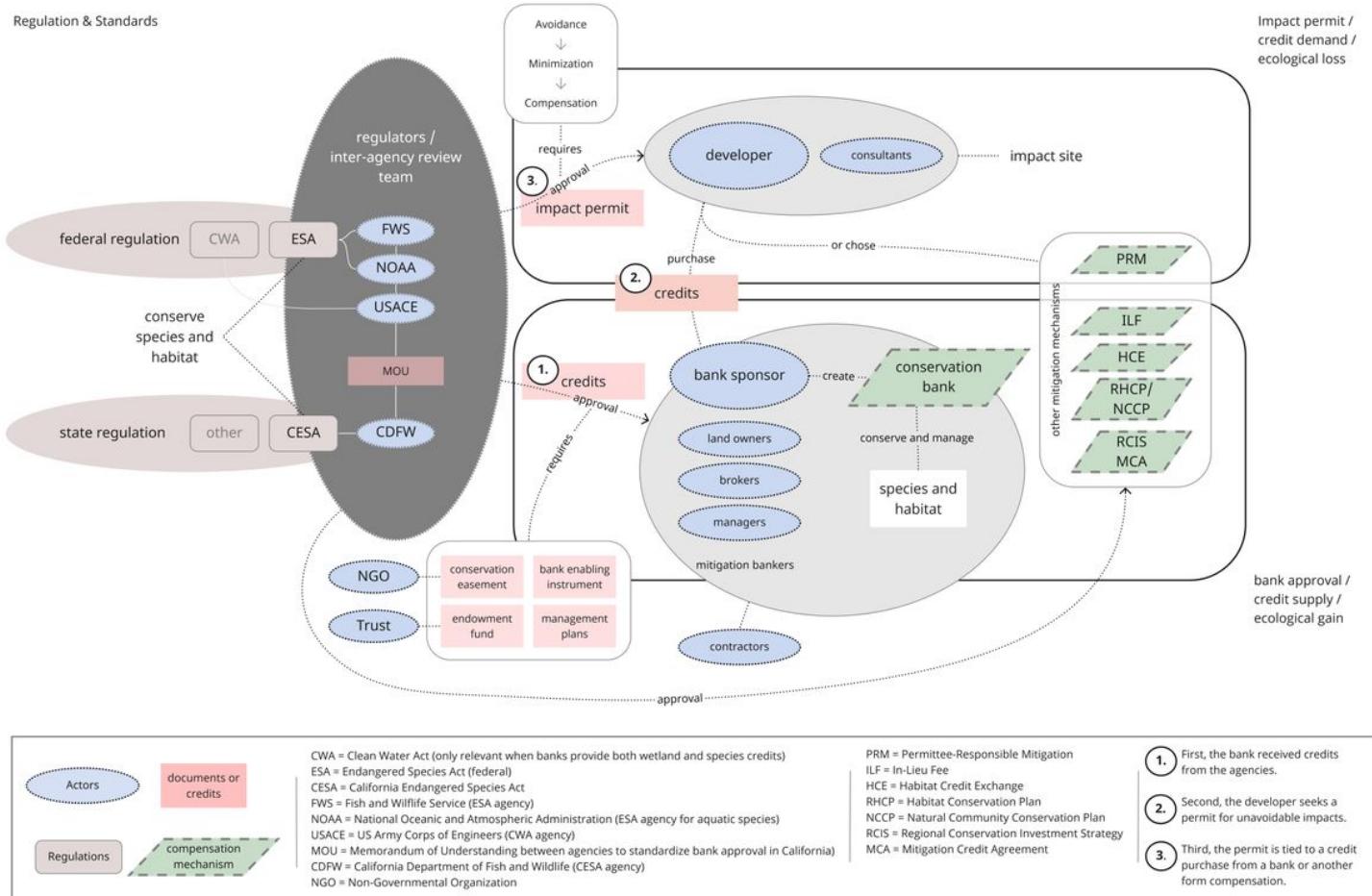


Figure 1

The California conservation banking program: Institutional framework. The left shows the legislation and regulatory agencies, the top right shows the impact permitting process, and the bottom right the bank

approval process and other compensation instruments.

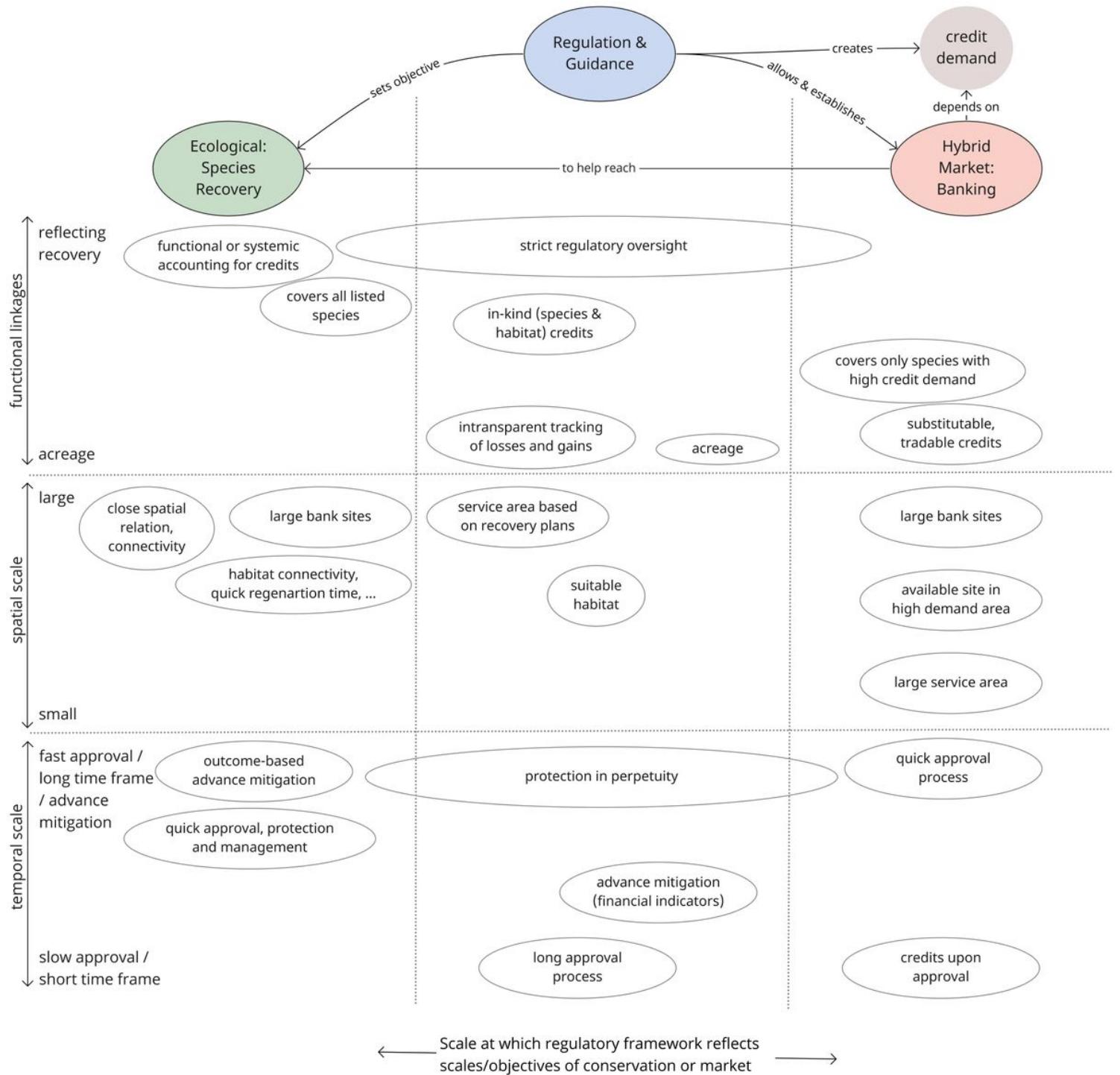


Figure 2

Social-Ecological Fit: Objectives and temporal, spatial and functional scales (reflected in three rows) of the ecological (left column), the economic (right column) sphere and how they are reflected by the regulatory framework (middle column).