APPENDIX S1: Scoring system for monitoring dilemma variables

A more user-friendly version of this appendix (as an interactive MS Access form) is available upon request from the author

p (probability of catching rule-breaker)		p=	

p_raw =min(1,p4)*p5   p_raw=

p = .01 if p_raw<=.01   p = .1 if .01<p_raw<=.1   p = .25 if .1<p_raw<=.25   p = .5 if .25<p_raw<=.5   p = .75 if .5<p_raw<=.75

p1: area to be covered by individual monitor = p1a/p1b/p1c		p1=
p1a: area of PA (km2)		p1a=
p1b: area of exploitable resource in question		p1b=
Protected resource scattered evenly over entire PA; fairly equal likelihood of exploitation anywhere	e.g. most PAs with human populations living within limits, or with nomadic / semi-nomadic people (e.g. nomadic pastoralists of hunters with camps); deep sea fishing	1
Protected resource patchy, but distributed throughout PA	e.g. river-based resources in terrestrial PA; forest-based resources in fragmented landscape; activities that generally occur within walking distance of a road (many roads within PA)	2
Protected resource heavily clustered but distributed throughout PA	e.g. fishing ponds, activities that generally occur within walking distance of a road (few roads within PA)	3
Exploitation generally occurs within close distance of border	e.g. most firewood, fodder collection, timber, grazing (by people living in outside settlements)	4
Resource in extremely localized clusters and close distance to border	e.g. shallow reefs, beach-seining,	5
p1c: number monitors: number of employed monitors (for top-town) or user group size (for community-based)		p1c=
p2: % area monitor can cover per hour (rough estimate¥ based on transportation mode) = p2a/p1		**p2=**
p2a: monitor's most common mode of transportation		p2a =
Car/boat/motorbike		5
Boat/bike/horse		2
Foot, easy to average terrain		1
Foot, difficult terrain	e.g. dense forest, mountains, swamp	0.5
p4: probability of detecting offender during a 4hr shift = p2*4*p4a		**p4=**
p4a: temporal predictability of illegal event:		p4a=
Sporadic event, lasts <1hr, can occur at any time, lasts <1hr	e.g. hunting illegal species where hunting is legal; Rare or opportunistic take of illegal species	0.167
Lasts 1-4hrs, but can happen at any time, including night	e.g. hunting or fishing	0.333
predictable schedule or lasts 4-8hrs	e.g. grazing, women gathering forest products, fishing with nets	0.5
Frequent event with signs of regular visitation, or lasts 8-24 hrs	e.g. small-scale swidden agriculture, mining, long term fishing nets	1
Permanent presence (can comfiscate assets even if offenser not there)	e.g. large-scale or permanent agriculture, residence	10
p5: probability of recognizing illegal activity If offender is observed = (p5a+p5b)/2		**p5=**
p5a: activity conspicuousness		p5a=
Resembles legal activity -- imperceptible	e.g. taking a similar but illegal species if activity is otherwise legal, surpassing quota, illegal activity that requires no/small tools in an area where people are otherwise allowed	0.1
Can be detected, but can pretend to be doing something else	e.g. Setting traps where people are otherwise allowed, hunting w/o permit where permits are common	0.5
Conspicuous	presence where people are not allowed, presence of livestock where livestock not allowed, using illegal and conspicuous equipment	1
p5b: product conspicuousness:		p5b=
product immediately indistinguishable from legal products	e.g. species caught illegally but indistinguishable from legally caught version, pearls, precious	0
small enough to fit in pocket	e.g. small NFTPs, orchids, animal parts,	0.1
Can fit in backpack	e.g. firewood, fodder, agricultural products, small to med animals	0.5
bulky and impossible to hide	e.g. med to large animals, timber	1

¥ based on rough estimation that a monitor can cover 1km2 per hour on foot (walking 4km/hr, with a detection range of a little over 100m in each direction)

C (cost of monitoring)		
Ccatch: if C3 = 5, Ccatch = 5 otherwise, Ccatch = (C1 + C2 + C3 + C4) / 4		**C=**

C1: Energy costs / discomfort:		
Can monitor from stationary location	p1<1 and habitat open	1
monitoring occurs in day, requires little physical activity	e.g. monitoring via car or boat	2
monitoring occurs in day with some physical activity, conditions normal	default for monitoring on foot	3
monitoring occurs at night or in day with bad conditions	mention of heat, cold, demanding terrain	4
monitoring occurs under excruciating conditions	e.g. ice, steep mountain,	5

C2: Opportunity cost / ability of monitor to multi-task		**c2=**
Monitors participate in same activity in same area as potential rule-breakers		1
Monitors do own activity, but in same area as potential rule-breakers		2
Monitoring takes some extra time, but can be done periodically	e.g. occasional raids, inspection of homes, watching a radar etc.	3
Monitors must devote most time to monitoring		4
Monitoring is full time job		5

C3: Safety costs: danger of monitoring / confronting a rule-breaker		**c3=**
No more risk than everyday life		0
minimal risk (wildlife, hostile but unarmed people with no history of violence)		1
some risk (harsh environment, dangerous wildlife, armed people but no history		2
considerable risk (armed people with some history of violence)		4
guerrillas out to kill		5

C4: Social costs: Potential social retaliation for punishing a rule-breaker		**c4=**
typical rule-breakers live in different community than monitor and have little political power; general community supports rule/role of monitor or neutral		0
typical rule breakers live in same community as monitor, but not related & have little political power; general community supports rule/role of monitor or neutral		1
typical rule-breakers are from different community than monitor and have little political power; general community views rule/role of monitor negatively		2
typical rule breakers live in same community as monitor, but not related & have little political power; general community views rule/role of monitor negatively		3
typical rule breakers are in monitor's family, village authorities, or people monitor relies upon; general community supports rule/role of monitor or neutral		4
typical rule breakers are in monitor's family, village authorities, or people monitor relies upon; general community views rule/role of monitor negatively		5

B(Benefit of resource) Bu = for individual user, Bm# = for monitor		
if Bu1=0 or Bu2=0, Bu=0; otherwise, Bu = (Bu1+((Bu3+Bu2)/2 -2)) max=5		**Bu=**
Bm = (Bm1 + (Bm2/2)) max=5		**Bm=**

Bu1/Bm1: Default value		**Bu1/Bm1=**
Worth nothing (no one wants to use resource regardless of rules)		0
A single take has little to no monetary value	e.g. Firewood, fodder, grazing livestock, many NTFPs	1
A single take has some monetary value	e.g. Fishing, hunting small-med animals, swidden agriculture, small-scale timber/mining	2
A single take has significant monetary value	e.g. Permanent agriculture/ranching/settlement, med-scale timber/mining, large animals	3
Lucrative business	e.g. trawling, ivory, oil, Large-scale forestry/mining,	4

Bu2: Alternative Sources		**Bu2=**
lots of alternative sources, no extra costs associated with using alternative sources	e.g. Can get same product legally - quality, distance, etc. all equal or worse for illegal source	0
lots of alternative sources, extra costs are minimal (slight inconvenience)	e.g. Can get same or similar product legally, but slightly farther/slightly lower quality/ slightly higher	1
some alternative sources, although some extra costs. (small life-change required or small decrease in income involved)	e.g. Can get same or similar product legally, but farther/lower quality/higher competition/lower return (e.g. with legal fishing method)/have to pay minimal access fees	2
alternative sources are much more costly (significant life-change required or decrease in income involved)	e.g. Can get same or similar product legally, but much farther/much lower quality/much lower return/have to purchase or pay large access fees	3
no alternative source	e.g. Fish/bushmeat/firewood/grazing where no legal sources exist & location is far from market. Land for settlement/agriculture where there are no legal options	4

Bu3: Role in subsistence		**Bu3=**
for recreation only		0
luxury item or minimally useful		1
useful, but not essential. May help with income/diet but not main contribution		2
important, but not only source of protein, calories, income, etc.		3
essential for subsistence, few to no other options		4

Bm2: Collective benefits beyond value of resource itself		**Bm2=**
value of resource taken = value lost	e.g. sustainable extraction or extraction of resources that have little to no indirect impact on national/local economies or of species considered pests	0
loss of resource causes other minimal per-capita losses	e.g. hunting/fishing in tourist areas visited for general ecosystem (rather than species itself), habitat destruction (grazing/firewood/clearing land) in slightly degraded lands	1
resource is keystone / it's loss causes loss of other resources	e.g. selective logging, mining, hunting keystone species (not critical for tourism)	2
extraction of resource causes severe damage beyond value of resource itself	e.g. clear-cutting primary forest, trawling, severe mining, cutting mangroves, dynamiting reefs	3
very limited resource, Critical for economy	e.g. killing animals that carry substantial tourism industry (e.g. mt. gorillas); dynamiting reefs	4

M (Direct benefit to monitor for catching a rule-breaker)#		**M=**
nothing or negative	e.g. there is no fine / users rarely have money or assets with which to pay fine / prison is the	0
very small	e.g. token fine/bribe	1
small to medium	e.g. small to medium fine or bribe, confiscation of assets of value (cattle, guns, crops)	2
high	e.g. companies with assets to pay large fines; confiscation of very valuable assets (boats, cars, permanent houses)	3