SocModelScenarios

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Function:

$\frac{dF_1}{dt} = r_1F_1(1-F_1) - \frac{h_1 * F_1(1-X_1)}{F_1+s_1} - i_2F_1 + i_1F_2$

$\frac{dF_2}{dt} = r_2F_2(1-F_2) - \frac{h_2 * F_2(1-X_2)}{F_2+s_2} - i_1F_2 + i_2F_1$

$\frac{dX_1}{dt} = k_1X_1(1-X_1)[\frac{1}{F_1+c_1} - \omega_1 + d_1(2X_1-1) + \rho_1(2X_2-1)]$

$\frac{dX_2}{dt} = k_2X_2(1-X_2)[\frac{1}{F_2+c_2} - \omega_2 + d_2(2X_2-1) + \rho_2(2X_1-1)]$

Table 1: Default parameter values used in this analysis

Parameter	Population_1	Population_2	Def
r	0.35	0.35	Fish net growth
s	0.8	0.8	Supply and demand
h	0.5	0.5	Harvesting efficiency
k	1.014	1.014	Social learning rate
ω	0.35	0.35	Conservation cost
c	1.5	1.5	Rarity valuation
d	0.5	0.5	Social norm strength (within pop)
i	0.2	0.2	Fish immigration (from patch)
ρ	0.5	0.5	Social norm strength (opposite pop)

Table 2: Starting values used in this analysis

Parameter	Population_1	Population_2
F	0.406	0.406
X	0.240	0.240

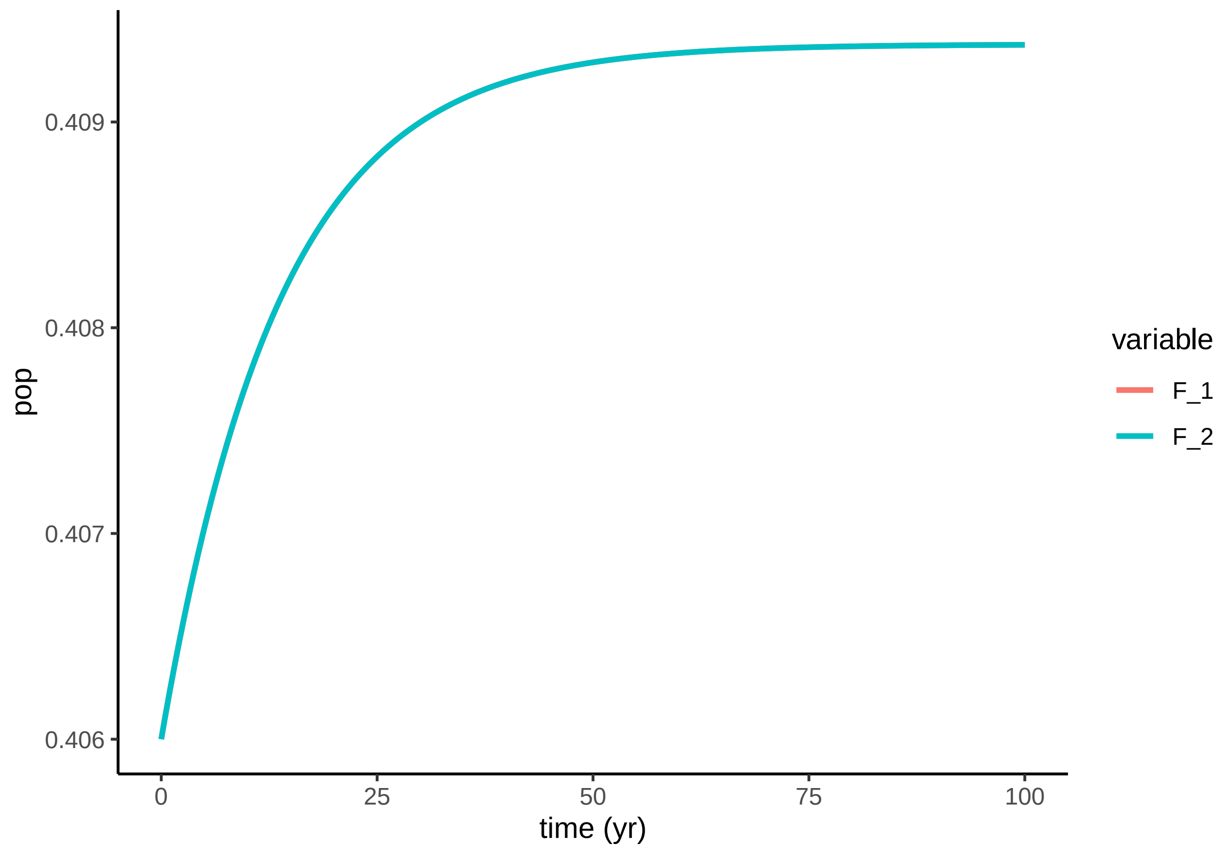

Figure 1: Model without social dynamics

Observations:

- Fishing remains sustainable UNLESS more than 50% of people are fishing

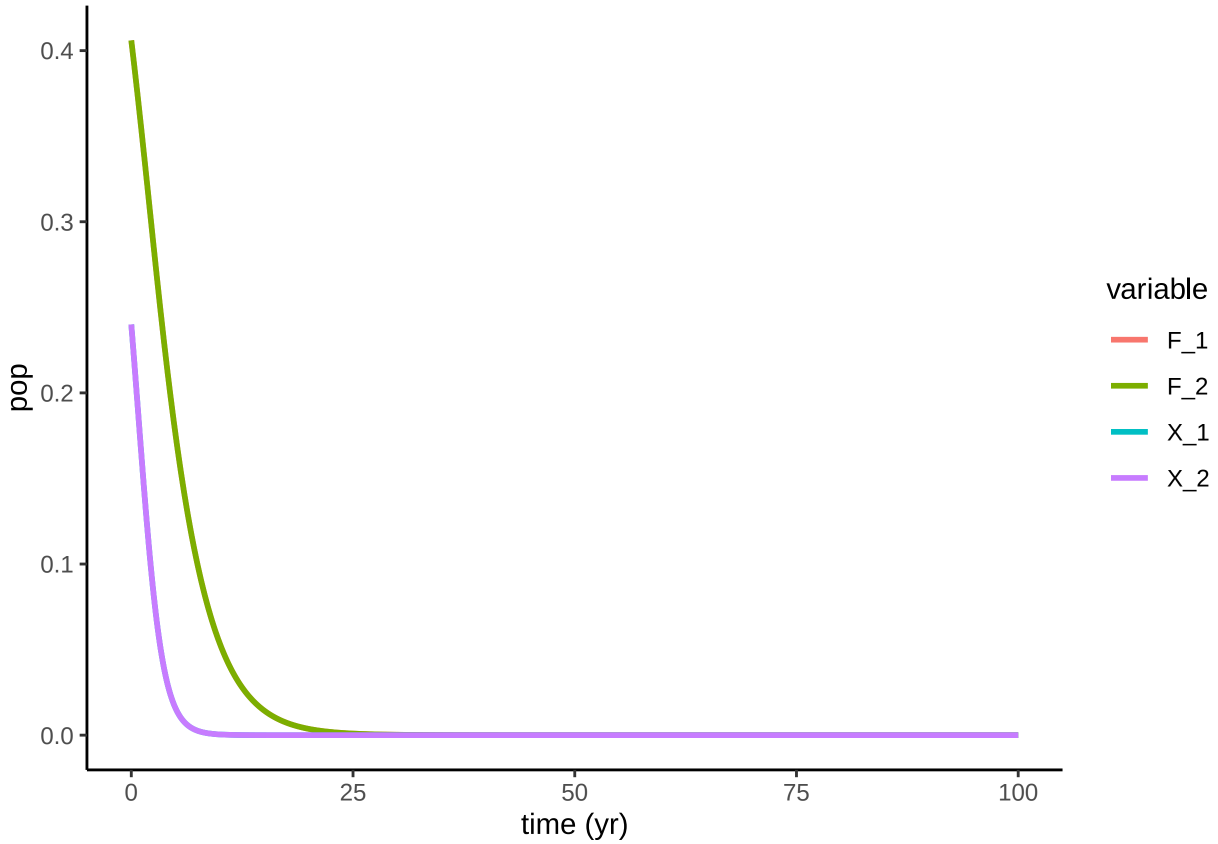

Figure 2: New Model with social dynamics

Observations:

- Still decreasing. Indicates that human dynamics consistently have fishers above 50%

Scenarios

One group tanking whole system

Table 3: Default parameter values used in this analysis

Parameter	Population_1	Population_2	Def
r	0.4	0.4	Fish net growth
s	0.8	0.8	Supply and demand
h	0.25	0.25	Harvesting efficiency
k	1.014	1.014	Social learning rate
ω	0.2	0.2	Conservation cost
c	1.5	1.5	Rarity valuation
d	0.5	0.5	Social norm strength (within pop)
i	0.2	0.2	Fish immigration (from patch)
ρ	0.5	0.5	Social norm strength (opposite pop)

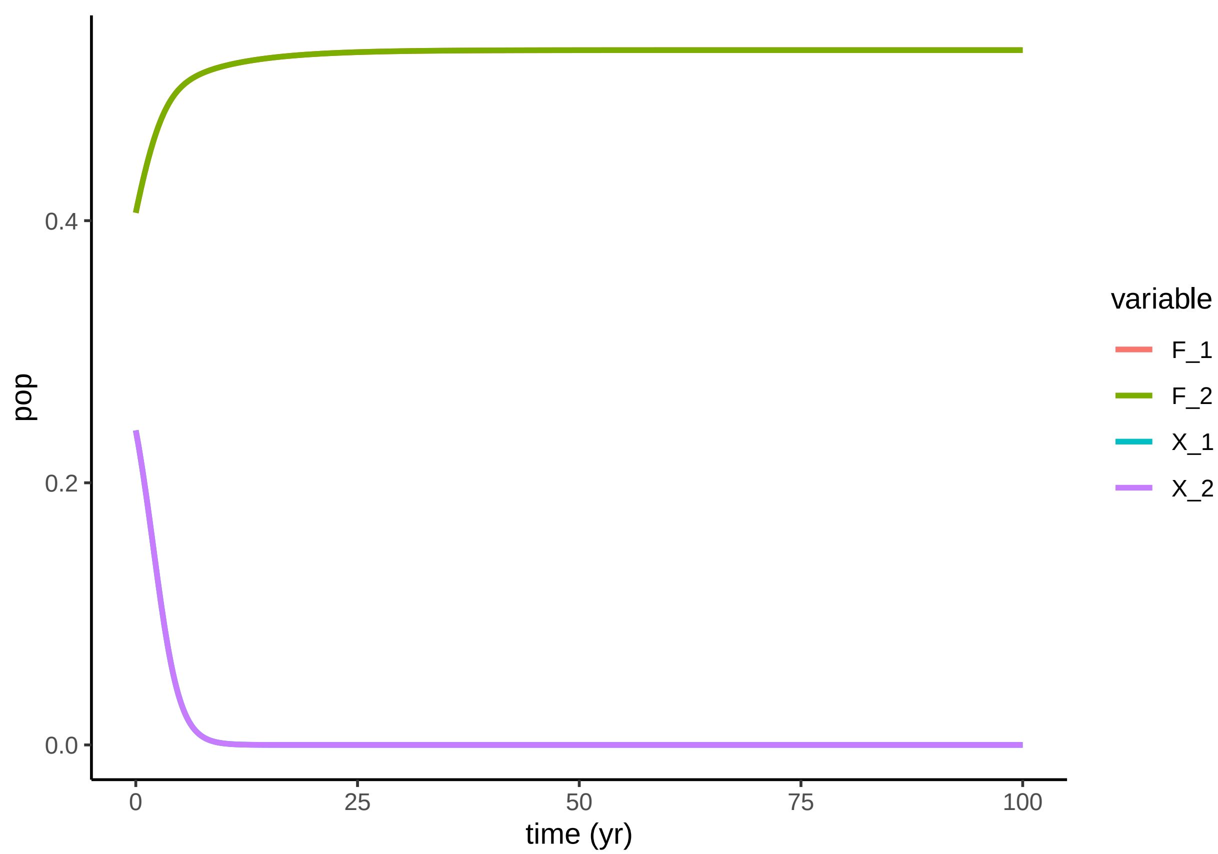

Figure 3: Changing fish growth, conservaiton cost, and harvesting efficiency for sustainable practices

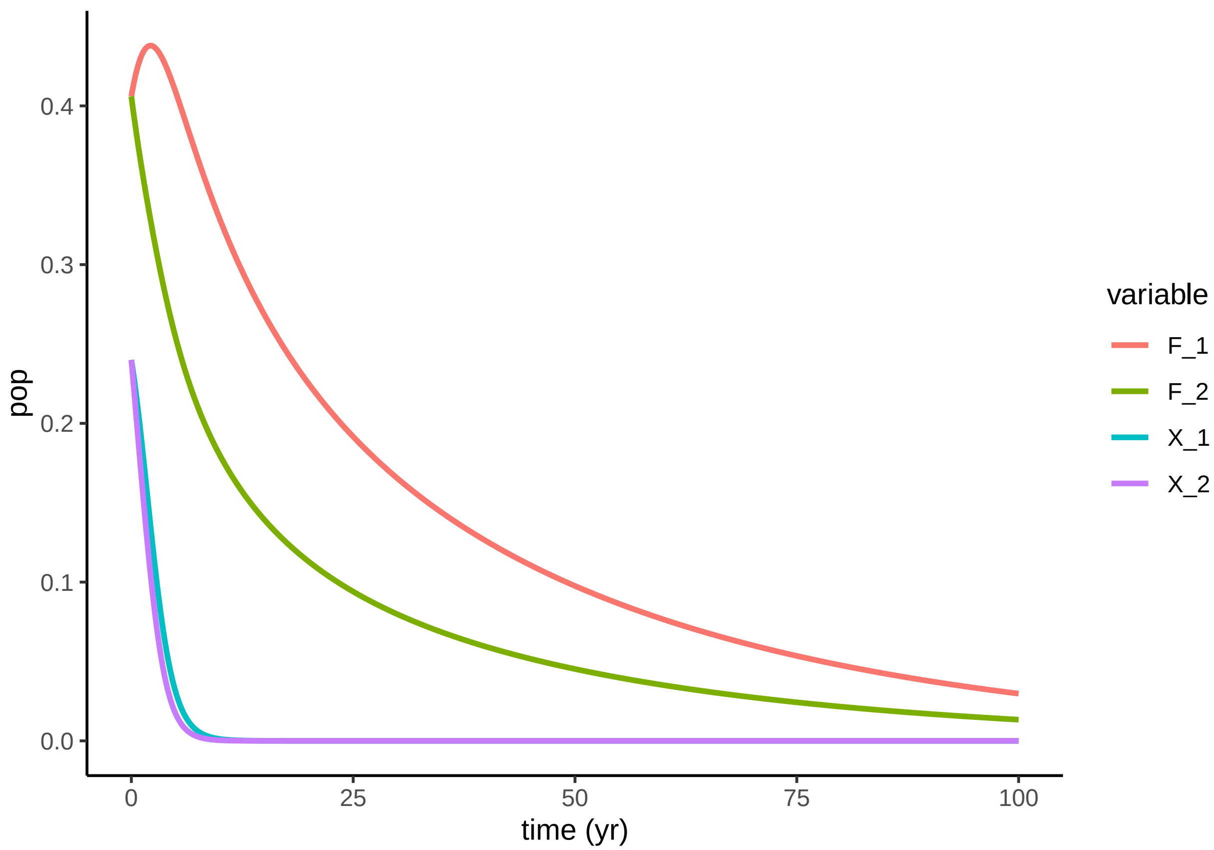

Figure 4: One group unsustainable practices scenario. Shows that one groups bad fishing can tank whole system

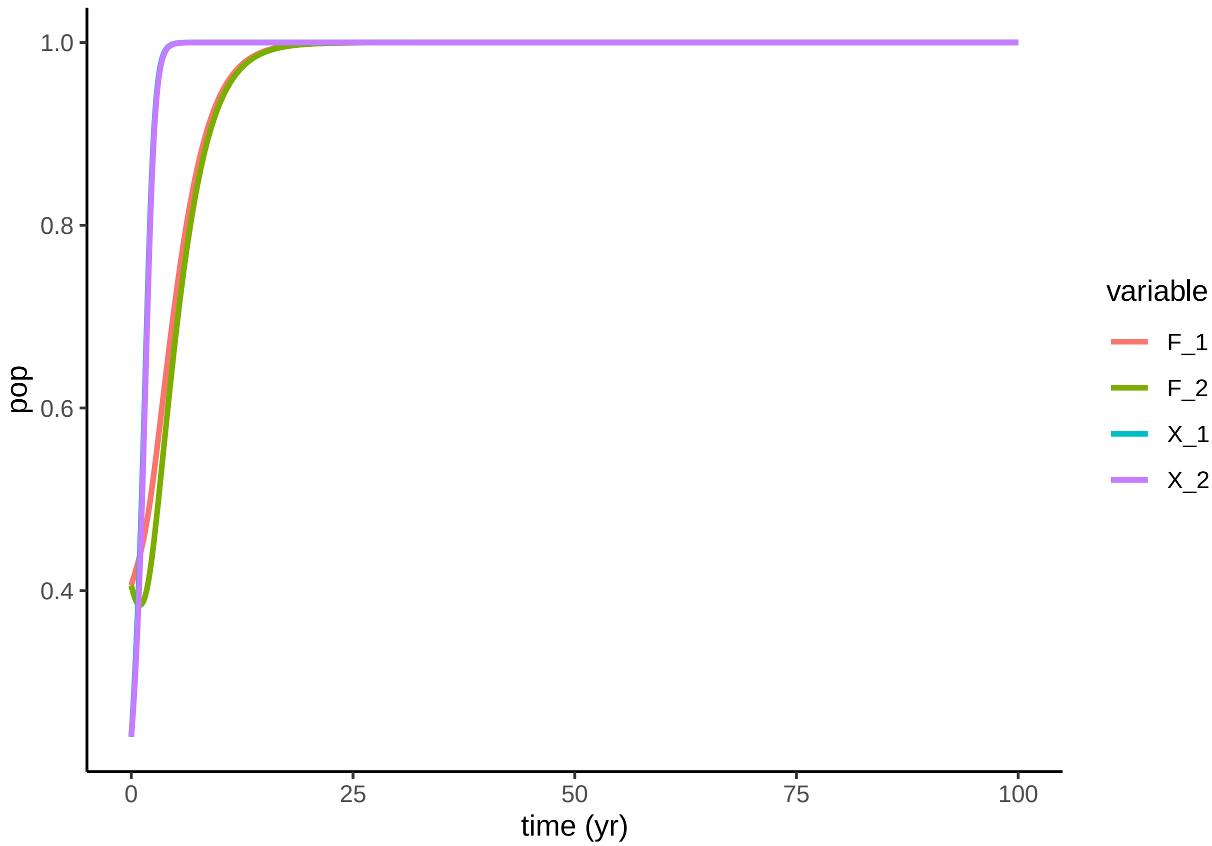

Figure 5: However, changing the rarity valuation parameters can recover the system

Heirarchy in decision making

Table 4: Default parameter values used in this analysis

Parameter	Population_1	Population_2	Def
r	0.35	0.35	Fish net growth
s	0.8	0.8	Supply and demand
h	0.5	0.25	Harvesting efficiency
k	0.17	1.014	Social learning rate
ω	0.35	0.35	Conservation cost
c	1.5	1.5	Rarity valuation
d	0.5	0.5	Social norm strength (within pop)
i	0.1	0.4	Fish immigration (from patch)
ρ	0.5	0.5	Social norm strength (opposite pop)

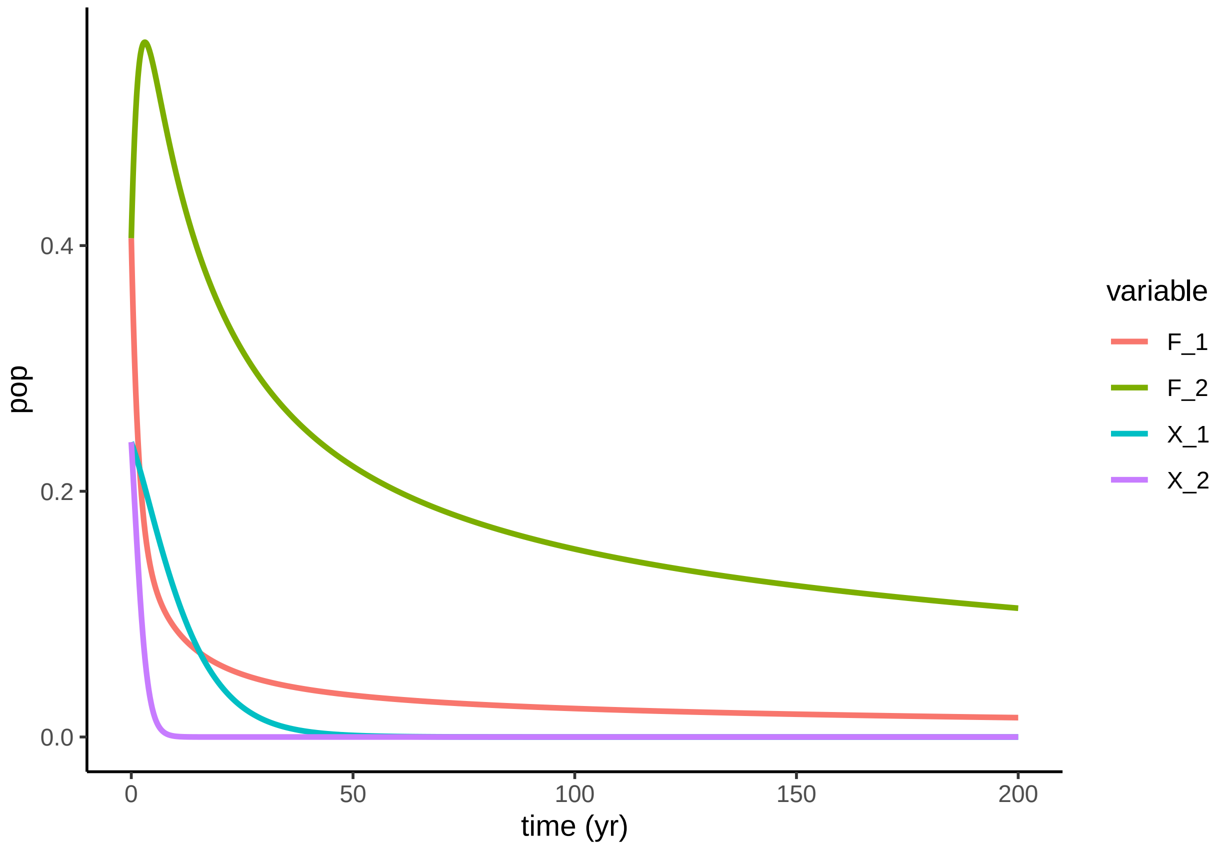

Figure 6: model with different fishing conditions in each patch

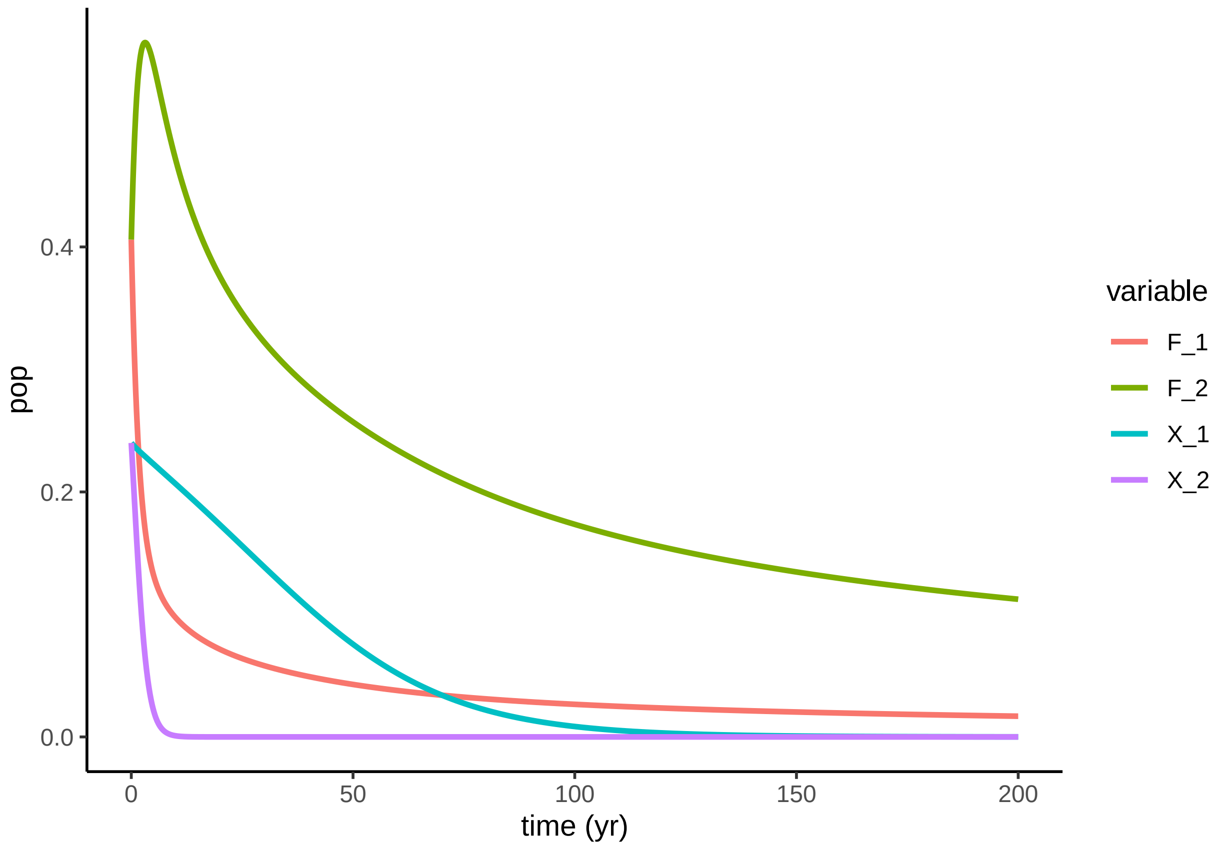

Figure 7: model with social inequity. idk does similar stuff but allows x1 to fish more

Dispersion Exploration

Table 5: Default parameter values used in this analysis

Parameter	Population_1	Population_2	Def
r	0.4	0.35	Fish net growth
s	0.8	0.8	Supply and demand
h	0.25	0.5	Harvesting efficiency
k	1.014	1.014	Social learning rate
ω	0.2	0.35	Conservation cost
c	1.5	1.5	Rarity valuation
d	0.5	0.5	Social norm strength (within pop)
i	0	0	Fish immigration (from patch)
ρ	0.5	0.5	Social norm strength (opposite pop)

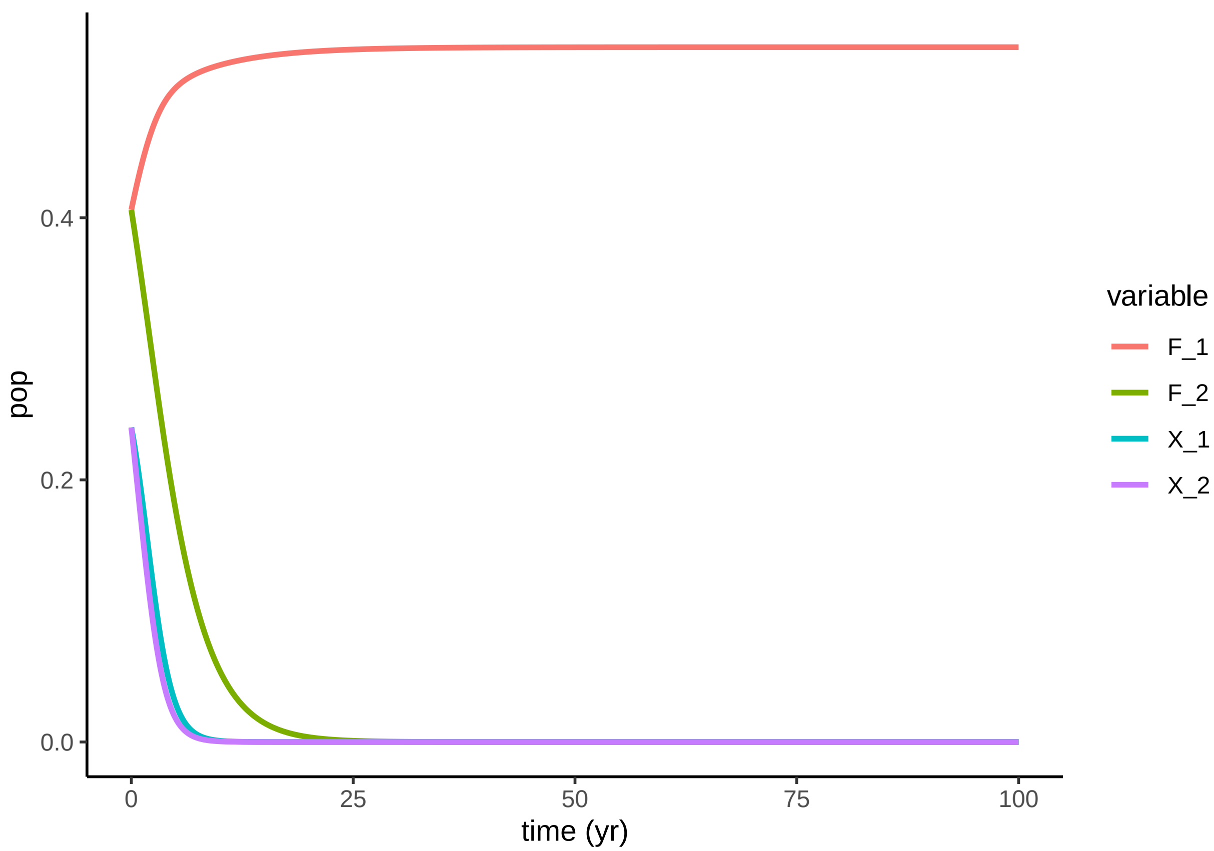

Figure 8: no dispersion. Unsustainable practices in one patch

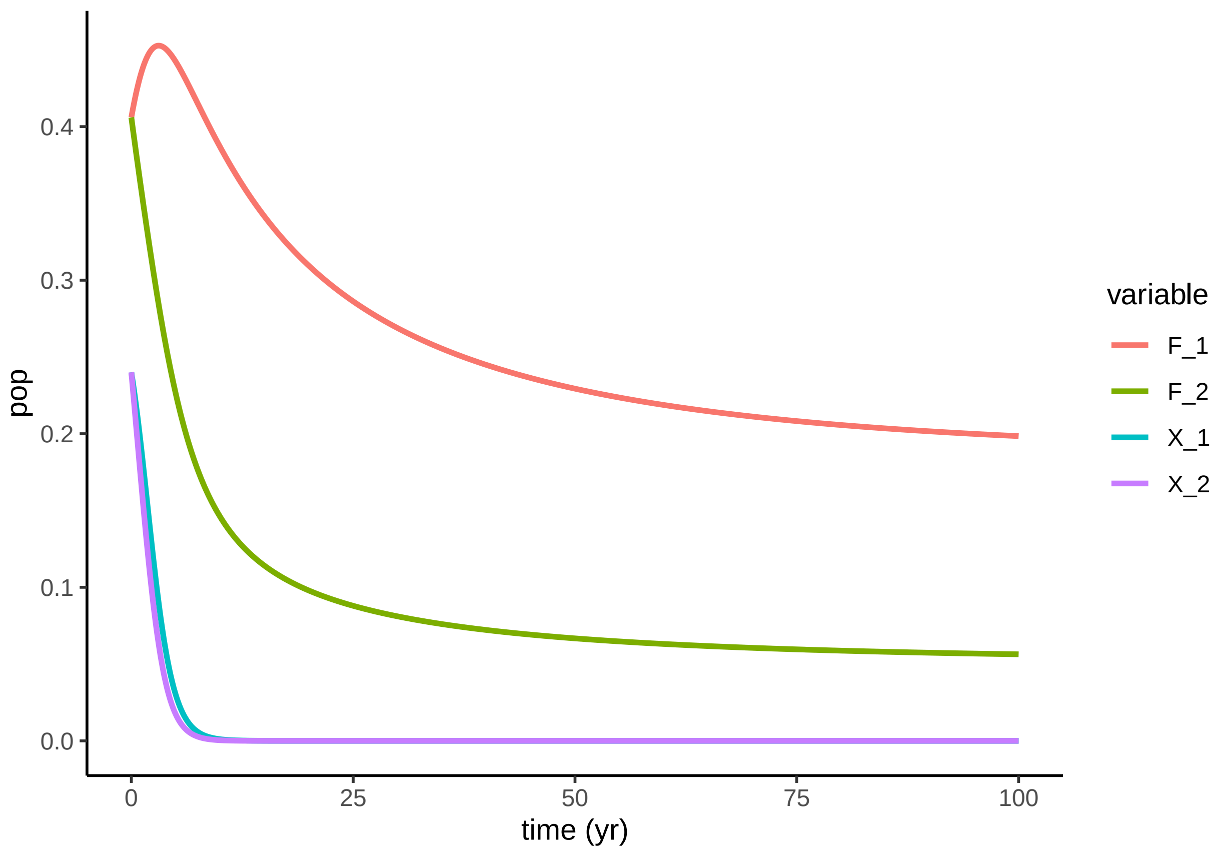

Figure 9: slow dispersion. Unsustainable practices in one patch. Note: no adjustment to rho or d could fix fishing scenario

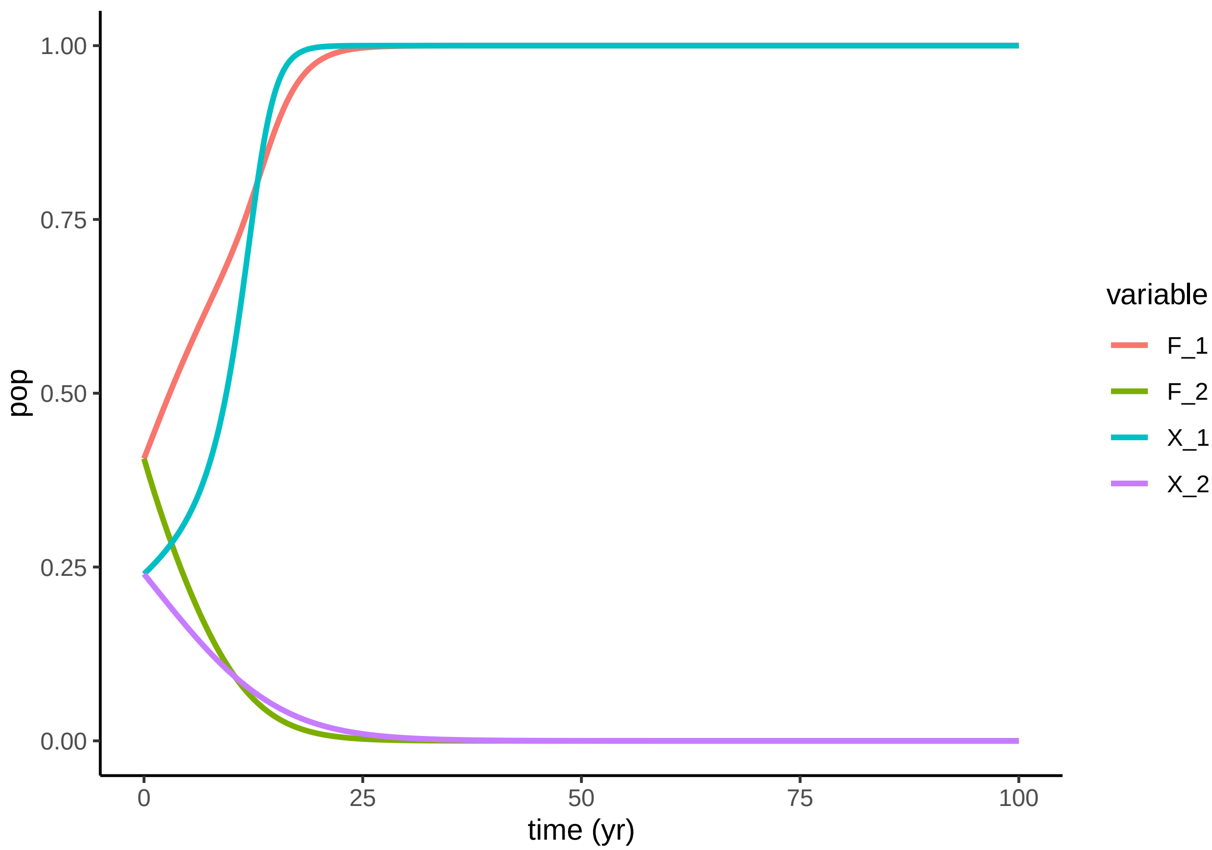

Figure 10: No social dynamics. Taking away rho doesn't really improve dynamics, but instead allows pop1 to take advantage of their sustainable fishing

Patch 1 all conservationists but fish pop is high

Table 6: Default parameter values used in this analysis

Parameter	Population_1	Population_2	Def
r	0.07	0.07	Fish net growth
s	0.8	0.8	Supply and demand
h	0.1	0.1	Harvesting efficiency
k	1.014	1.014	Social learning rate
ω	0.35	0.35	Conservation cost
c	1.5	1.5	Rarity valuation
d	0.5	0.5	Social norm strength (within pop)
i	0.07	0.2	Fish immigration (from patch)
ρ	0.5	0.5	Social norm strength (opposite pop)

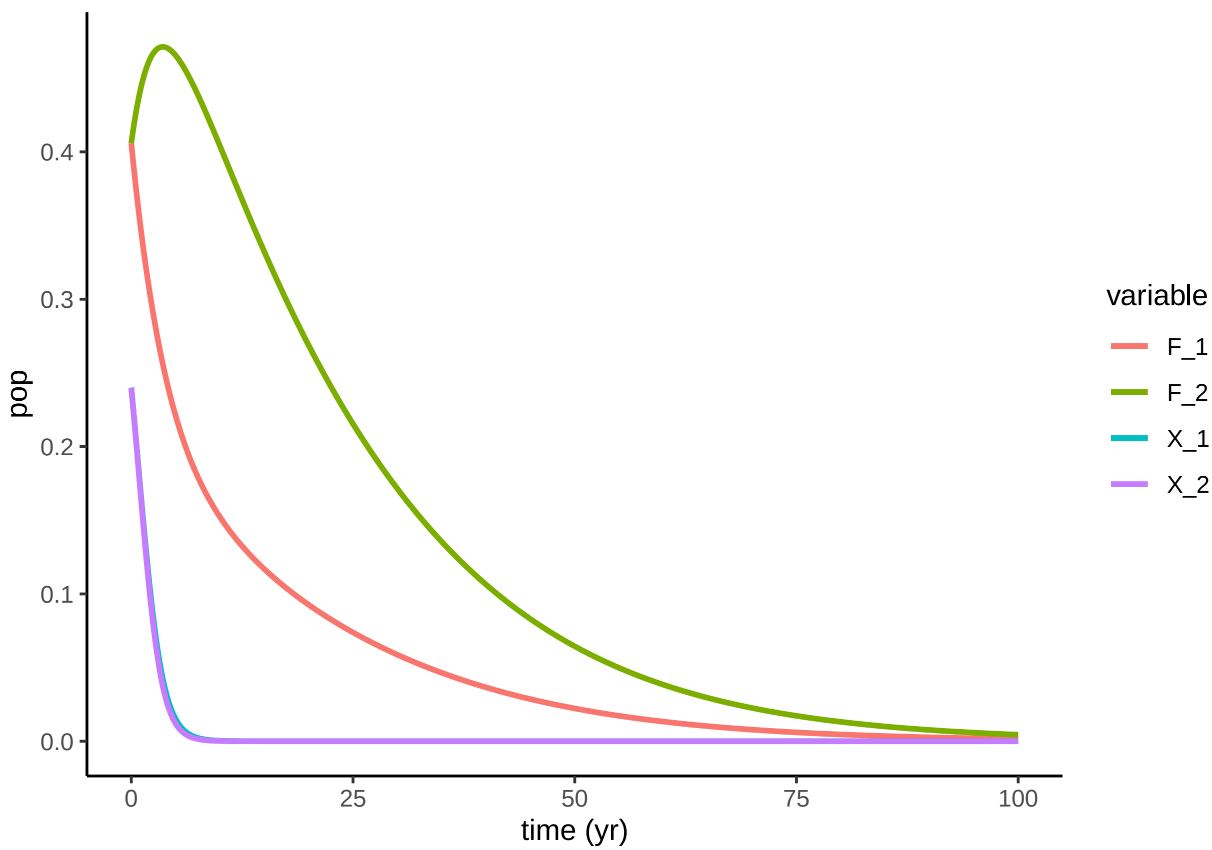

Figure 11: Hypothetical Madagascar. Can change H, S, omega, rho

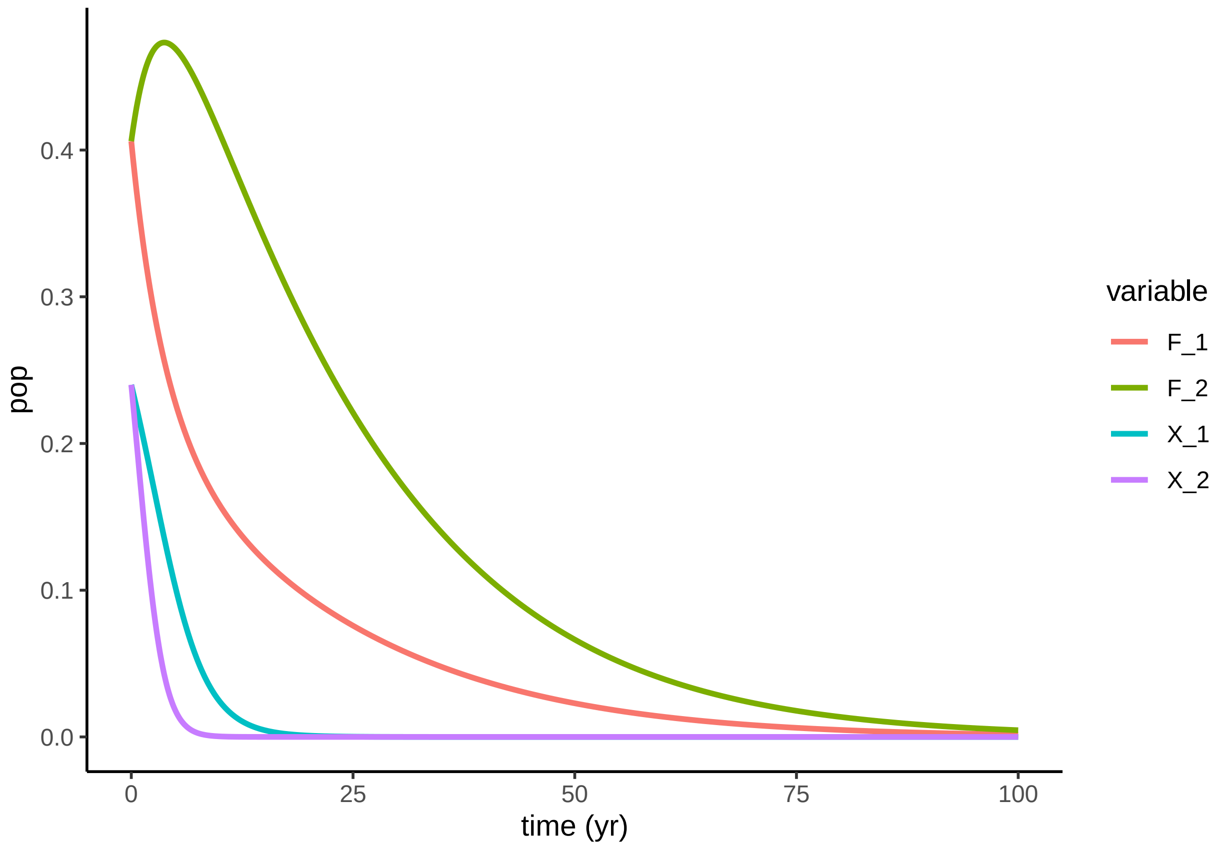

Figure 12: Hypothetical Madagascar with social inequity