

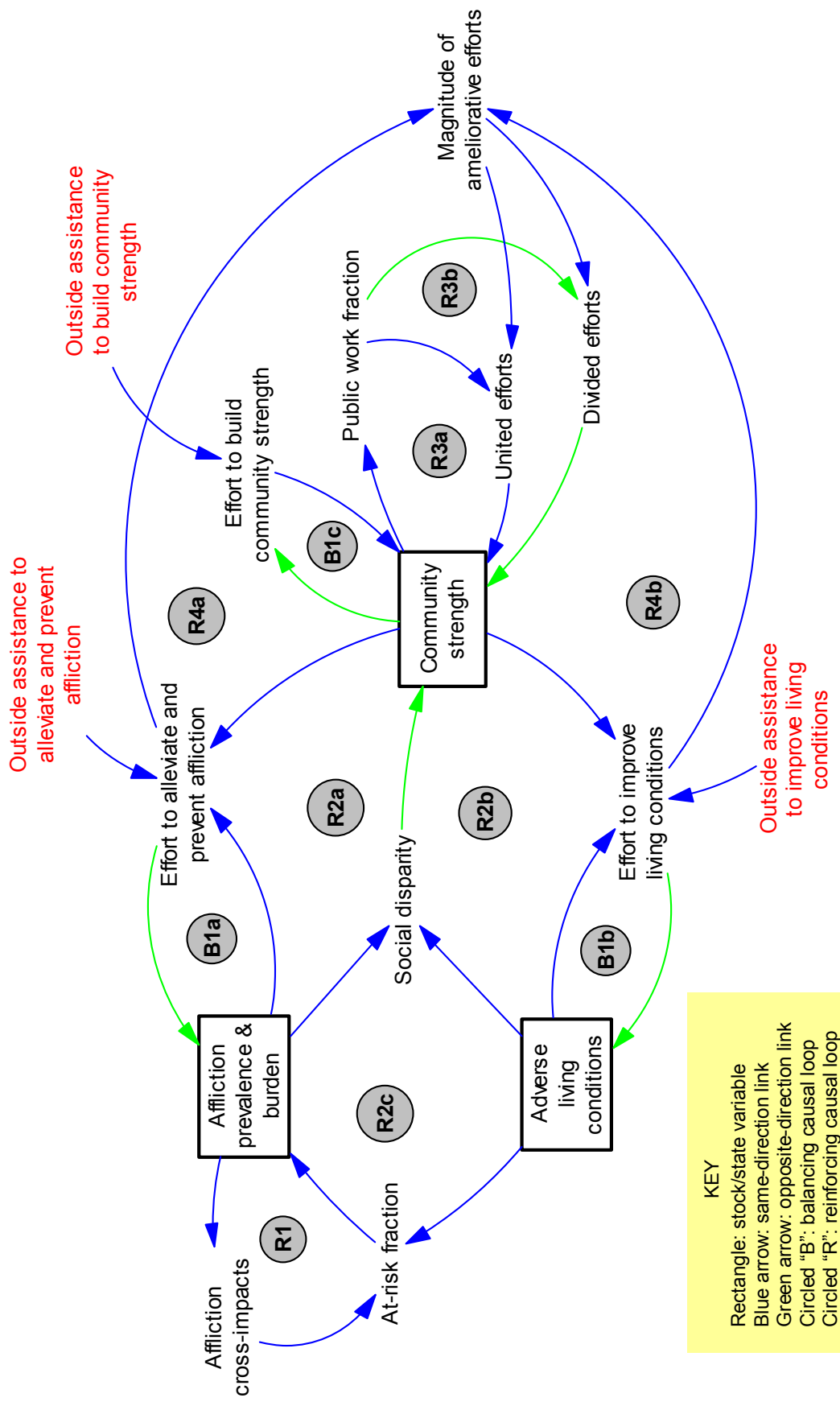
A Dynamic Simulation Model of Syndemics: Causal Structure, Assumptions, and Results

April 2003

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Model overview diagram



About the causal loops

- R1**

Syndemic: Each affliction increases vulnerability to other afflictions, thereby amplifying the effect of increases or decreases in the prevalence of individual afflictions.
- B1**

The community makes efforts to fight affliction and adverse living conditions in response to their prevalence, and to build greater community strength when it is perceived as low. Outside assistance may bolster such efforts.
- R2**

These efforts, especially those to fight adverse living conditions, are greater in magnitude when the community is strong and unified. But community strength is hindered by social disparity, which, in turn, is made worse by the very afflictions and adverse living conditions the efforts are trying to fight.
- R3**

Community strength is also affected by the efforts themselves, depending on their type. United efforts (public work) build greater strength, while divided efforts (professional work) do the opposite. A stronger community is more likely to engage in public work, while a weaker community will tend to rely upon professional work. Community strength and the unity or division of efforts are thus mutually reinforcing.
- R4**

The community strength loops are most “vicious” or “virtuous” when a high level of effort is being expended to fight problems. When problems spread in a strong community, the *united* response reinforces the community’s strength. Conversely, when problems spread in a weak community, the *divided* response reinforces the community’s weakness. Outside assistance to fight affliction or adverse living conditions, if not accompanied by assistance to build community strength, may thus undermine the internal capability of a community unless that community is strong to begin with.

Community specifics

The community is relatively poor and powerless, and has significant afflictions, adverse living conditions, and low community strength:

- Affliction
Prevalence initial: 17%
- Adverse living conditions
Initial: 22%
'Baseline': 26%
(Where system would settle absent any living conditions programs; reflects community income level)
- Community strength
Initial: 29%
'Baseline': 40%
(Where system would settle absent any social disparity, and with a neutral balance of public and professional work; reflects extent of common purpose and commitment)

Other assumptions (1)

- Affliction
 - Baseline at risk fraction 10%
 - Max additional at risk fraction from affliction cross impact 40%
 - Max additional at risk fraction from living conditions 75%
 - Baseline non-contagious incidence rate (% of at-risk) 10%/year
 - Baseline contagious incidence rate (% of at-risk contacted) 60%/year
 - Baseline affliction recovery rate 10%/year
 - Effect of max programs on affliction incidence 60%
 - Effect of max programs on affliction severity 60%
 - Effect of max programs on affliction recovery 200%
 - Affliction prevalence causing full program demand 20%
 - Internal capacity for affliction pgms if no commun strength 33%
 - Max boost in affliction programs from assistance 30%

Other assumptions (2)

- Adverse living conditions
 - Living conditions improvement time 4 years
 - Living conditions erosion time 8 years
 - Effect of max programs on adverse living conditions 50%
 - Adverse living conditions causing full program demand 20%
 - Internal capacity for LC programs if no commun strength 0%
 - Max boost in LC programs from assistance 50%
- Social Disparity
 - Affliction prevalence indicating 100% social disparity 50%
 - Adverse conditions prevalence indicating 100% disparity 50%
 - Weight on affliction (vs. living conditions) for social disparity 40%

Other assumptions (3)

• Community Strength	
Community strength development time	4 years
Community strength erosion time	8 years
Effect of max social disparity on community strength	50%
Effect of max public work on community strength	200%
Effect of max professional work on community strength	50%
Max public work fraction (when strength=100%)	80%
Weight on affliction (vs. conditions) programs for strength	50%
Max boost in community strength from assistance	30%

Tests of outside assistance

(assistance starts at Year 0 and ends at Year 12; in the following tests the split of assistance is held fixed for the entire 12 years)

FLAT: No outside assistance

AF100: 100% of assistance goes to fight afflictions

LC100: 100% of assistance goes to improve living conditions

CS100: 100% of assistance goes to build community strength

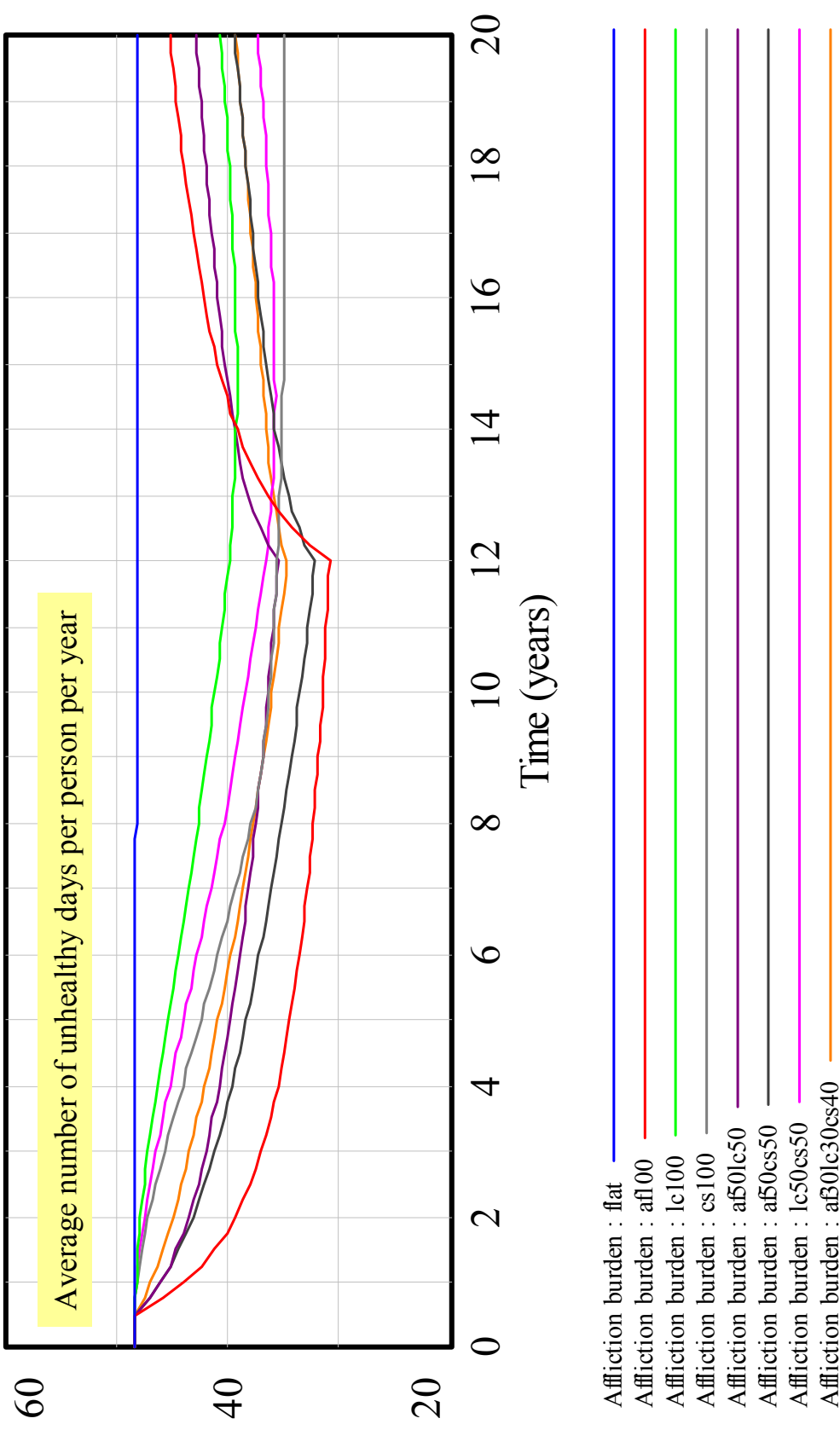
AF50LC50: 50% to fight afflictions, 50% to improve conditions

AF50CS50: 50% to fight afflictions, 50% to build strength

LC50CS50: 50% to improve conditions, 50% to build strength

AF30LC30CS40: 30% afflictions, 30% conditions, 40% strength

Affliction burden

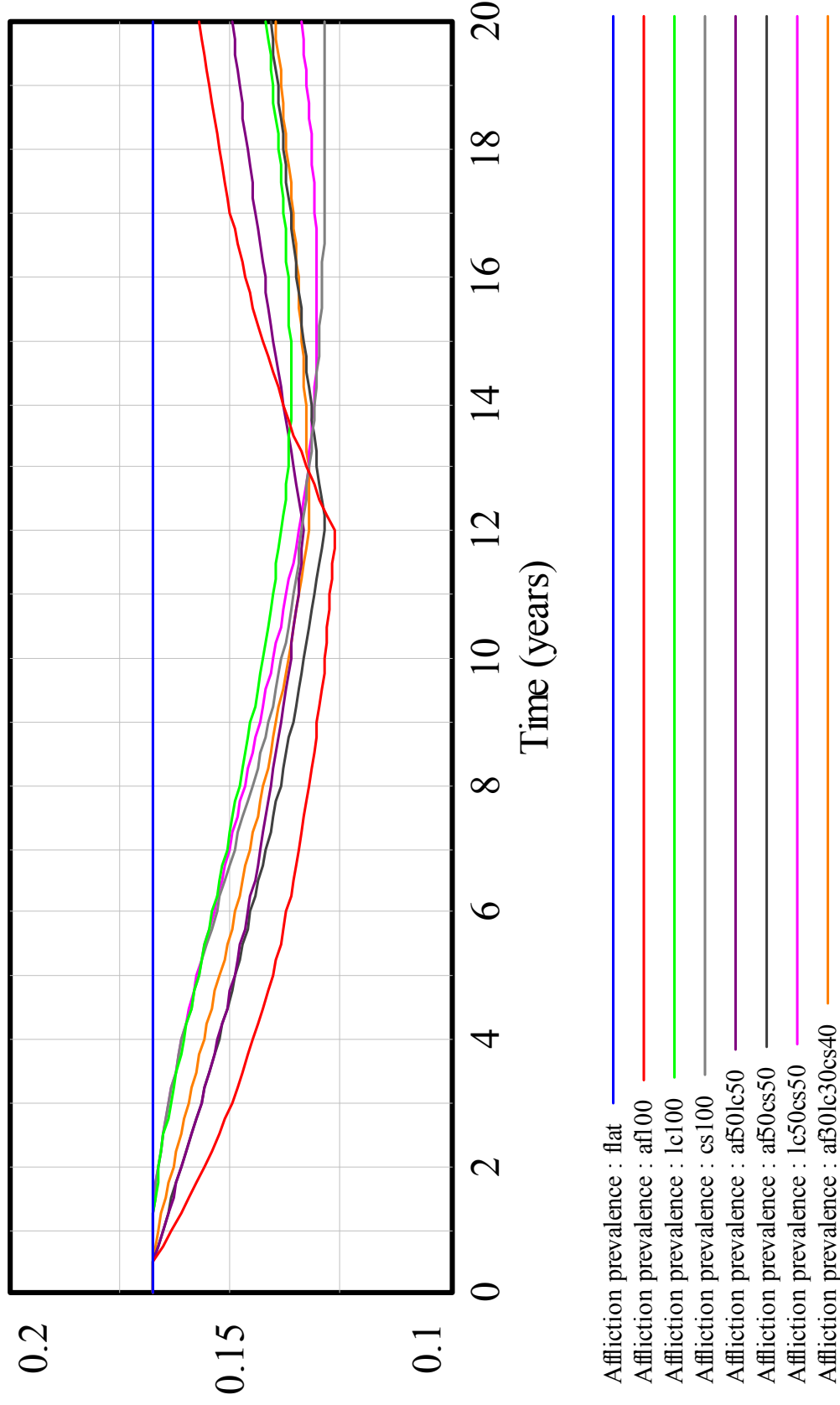


AF100 is best at reducing affliction when assistance is active, but falls to worst after assistance is cut off.

CS100 is best after the assistance is cut off, but does less to reduce affliction during the time of assistance.

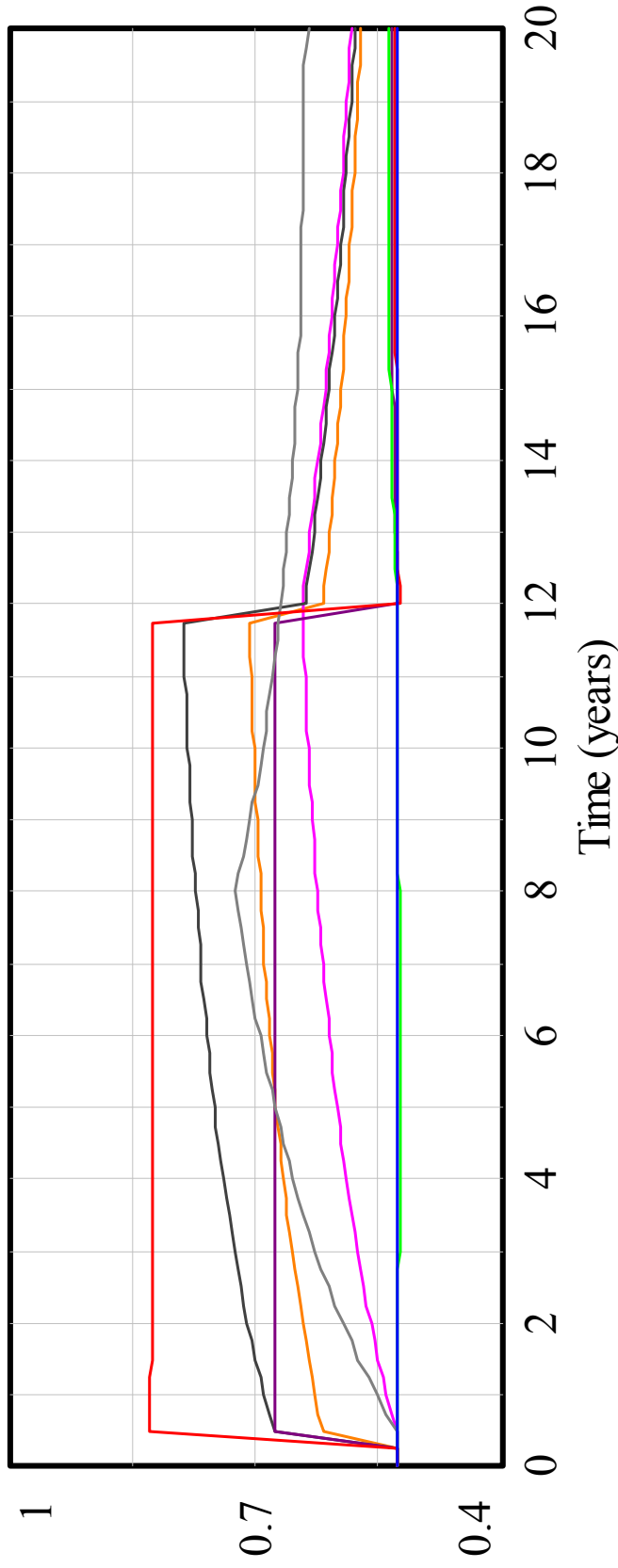
A mix like AF50CS50 that includes both affliction fighting and strength building does reasonably well during both time periods.

Affliction prevalence



Affliction burden (previous slide) is computed from Affliction prevalence (this slide), and the mitigating effect of affliction programs (next slide) on affliction severity. Absent affliction programs, affliction burden equals (365 x Affliction prevalence).

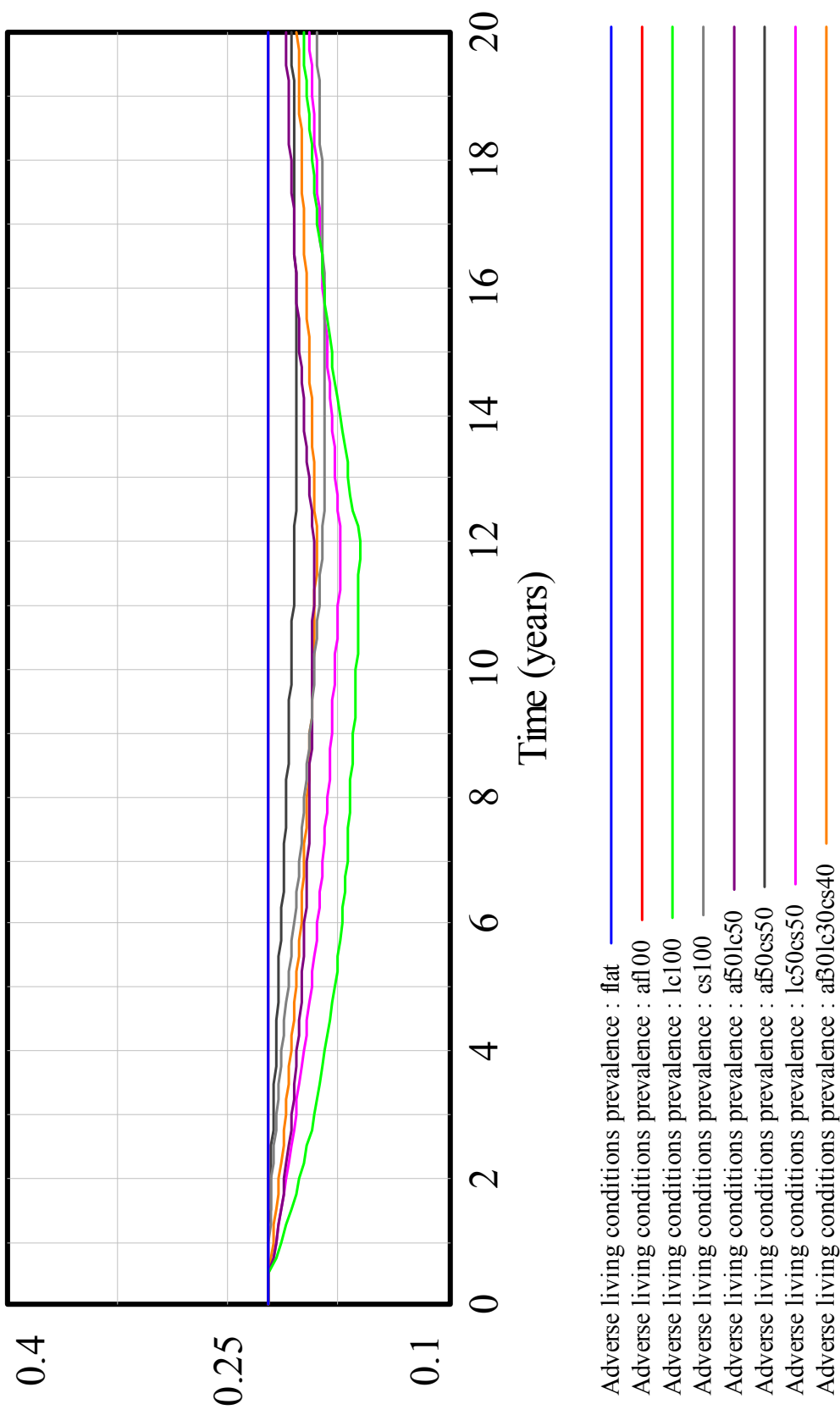
Affliction programs



Affliction programs : ffat
Affliction programs : afl00
Affliction programs : lc100
Affliction programs : cs100
Affliction programs : af50lc50
Affliction programs : af50cs50
Affliction programs : lc50cs50
Affliction programs : afB0lc30cs40

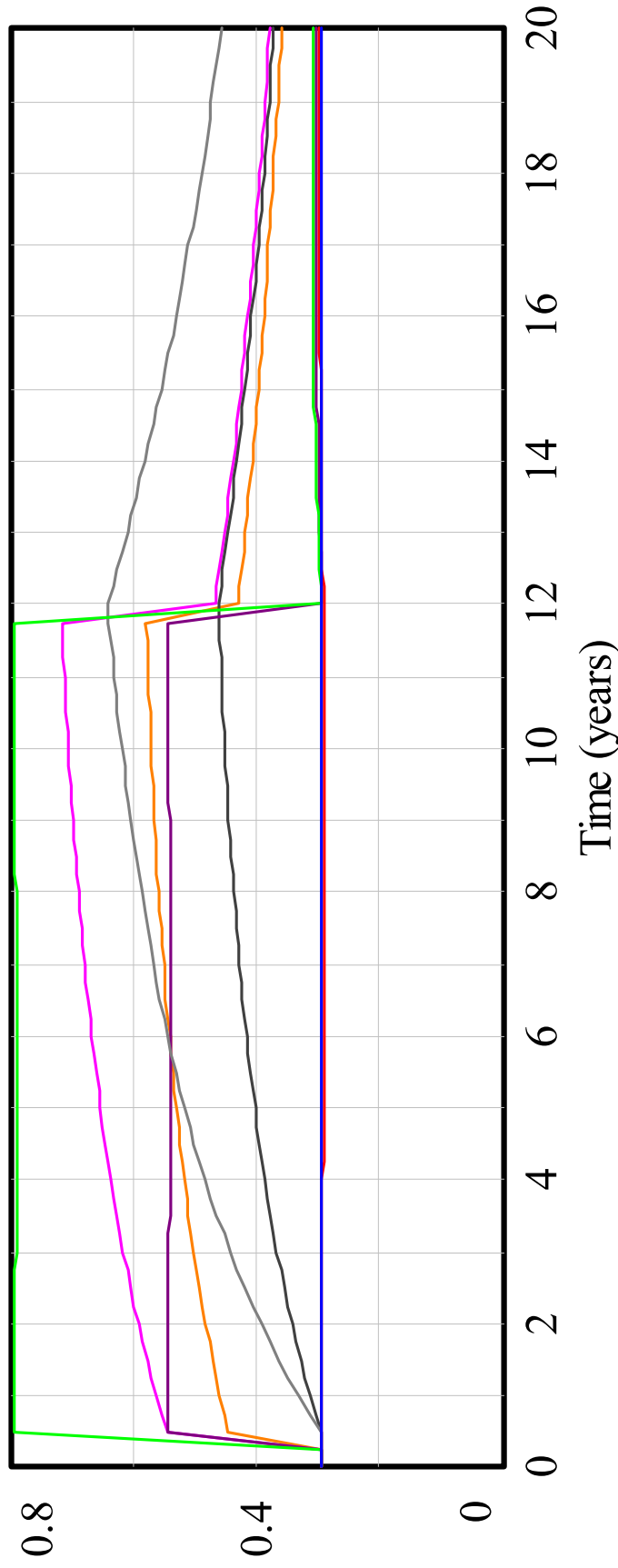
Assistance that builds community strength (as in CS100) ensures that affliction programs will be sustained at a higher level after the assistance is terminated.

Adverse living conditions prevalence



LC100 is best at improving conditions when assistance is active, but falls behind after assistance is cut off.
CS100 is best after the assistance is cut off, but does less to improve conditions during the time of assistance.
A mix like LC50CS50 that include both conditions improvement and strength building does well during both time periods.

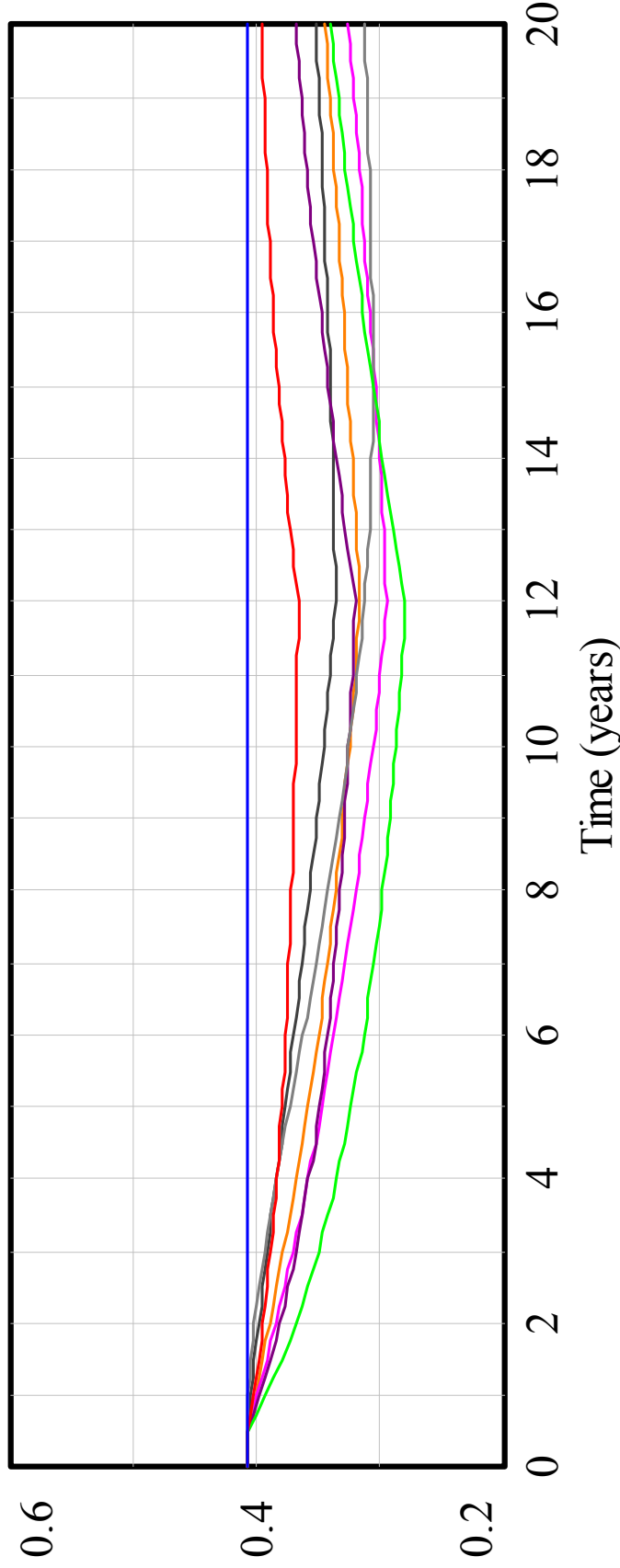
Living conditions programs



- Living conditions programs : flat
- Living conditions programs : afl00
- Living conditions programs : lc100
- Living conditions programs : cs100
- Living conditions programs : a50lc50
- Living conditions programs : a50cs50
- Living conditions programs : lc50cs50
- Living conditions programs : aβ0lc30cs40

Assistance that builds community strength (as in CS100) ensures that living conditions programs will be sustained at a higher level after the assistance is terminated.

Social disparity



Social disparity : flat

Social disparity : afl100

Social disparity : lc100

Social disparity : cs100

Social disparity : af50lc50

Social disparity : af50cs50

Social disparity : lc50cs50

Social disparity : af30lc30cs40

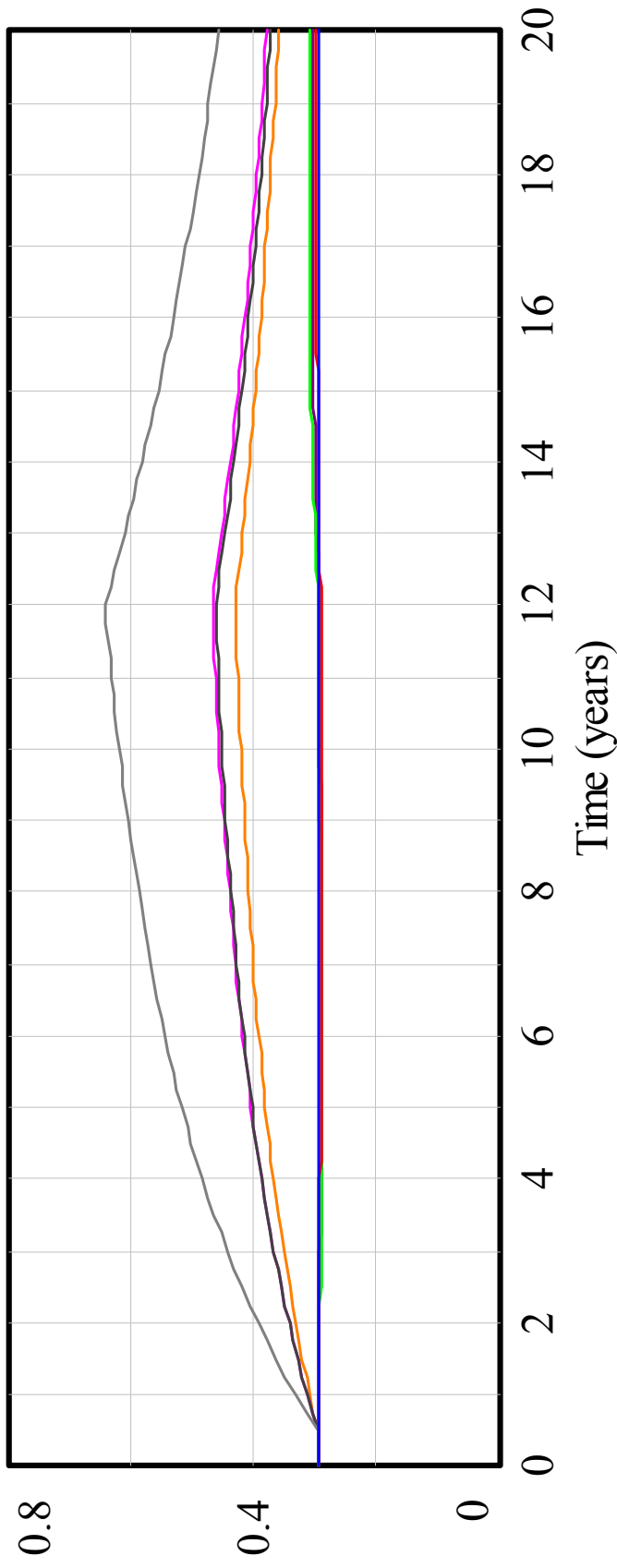
Social disparity is more heavily influenced by adverse living conditions than by affliction prevalence.

Thus, LC100 is the most effective type of assistance for reducing social disparity while assistance is active.

Again, CS100 is the most effective for after assistance is terminated.

A mix like LC50CS50 that includes both conditions improvement and strength building does reasonably well during both time periods.

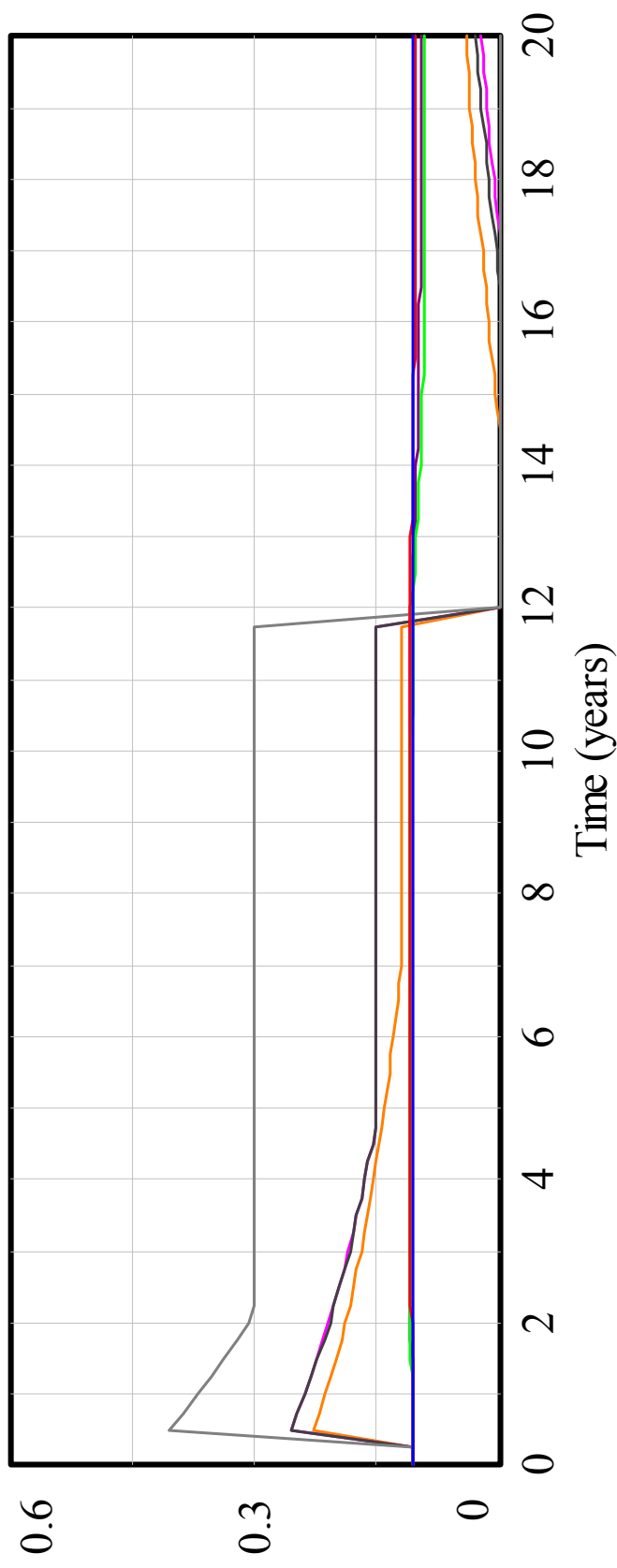
Community strength



- Community strength : flat
- Community strength : af100
- Community strength : lc100
- Community strength : cs100
- Community strength : af50lc50
- Community strength : af50cs50
- Community strength : lc50cs50
- Community strength : af30lc30cs40

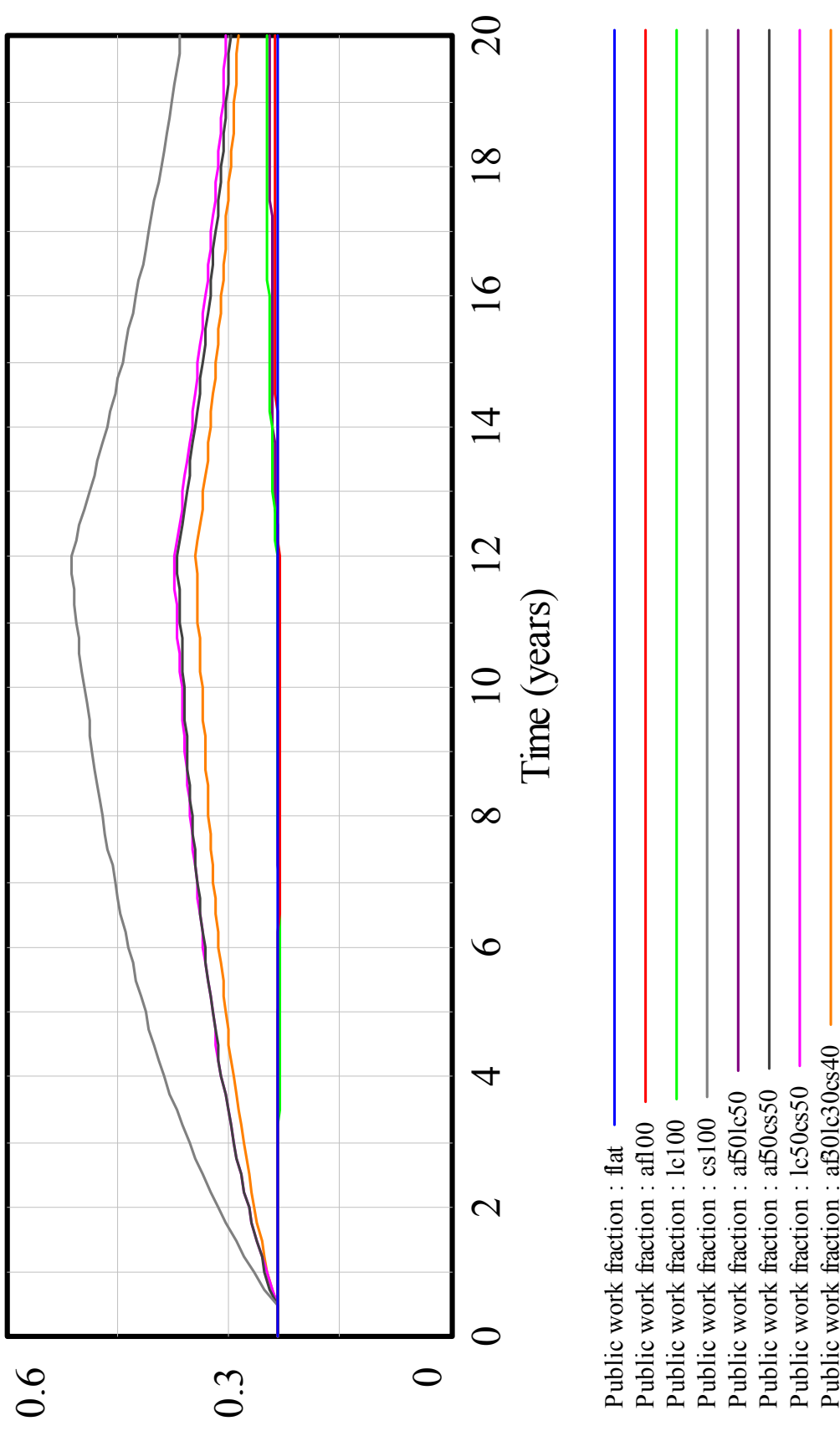
Community strength is most influenced by outside assistance to build such strength, as in CS100. Social disparity does not change enough in these runs to make much of an impact on community strength. The building of strength is self-propelling to some degree due to the public work that emerges from this strength. However, once the assistance is removed, the community gradually reverts back to a lower level of strength.

Efforts to build community strength



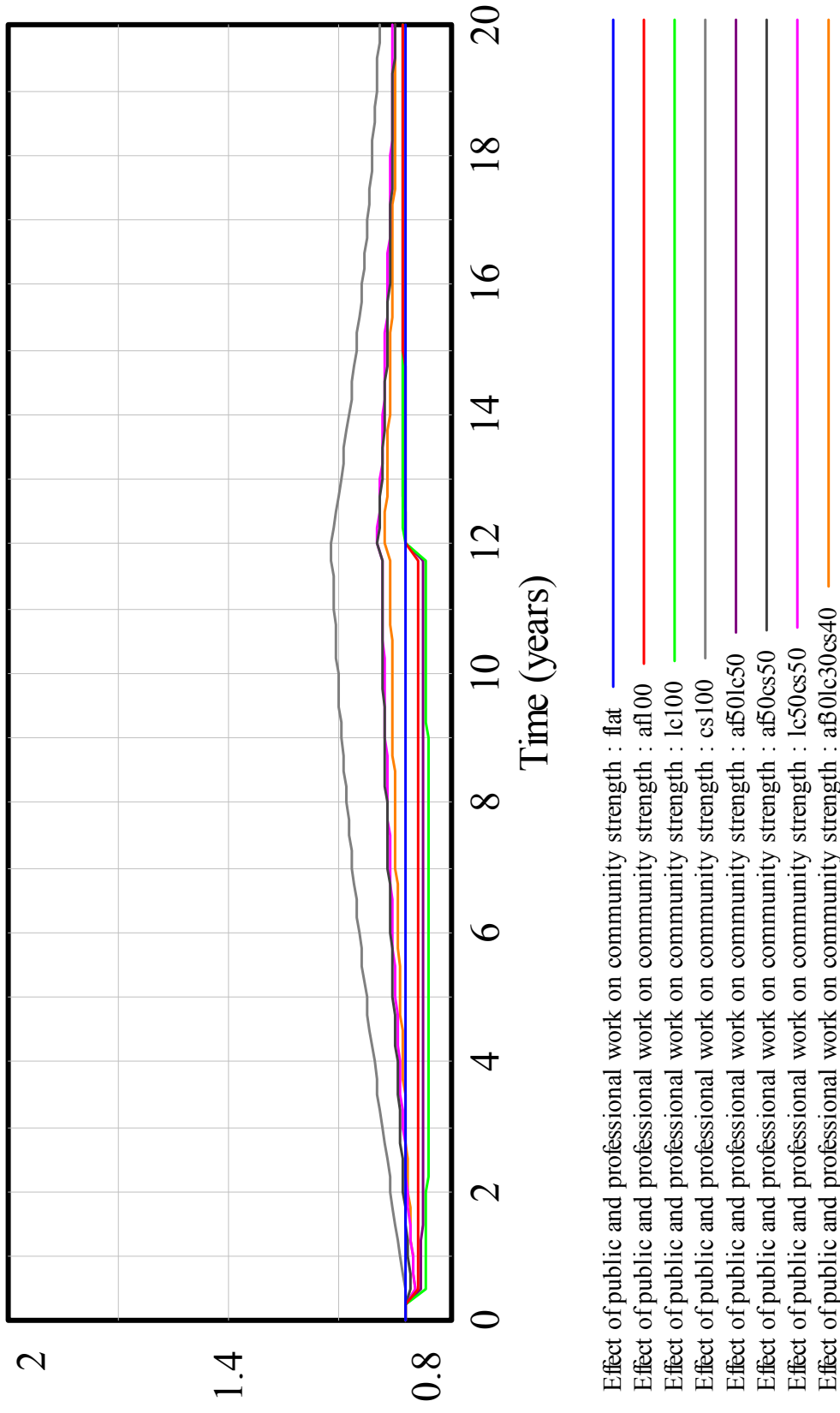
Endogenous (internally generated) efforts to build community strength are undertaken when strength (see previous slide) is below its baseline value of 0.4. Other efforts are due to outside assistance.

Public work fraction



The public work fraction is assumed simply proportional to community strength.

Effect of public and professional work on community strength



This graph illustrates the net effect of the R3 “work” loops on community strength, which, if greater than 1 (as in seen in any of the runs with some outside strength assistance), helps to propel strength to a higher level than it would have achieved otherwise.