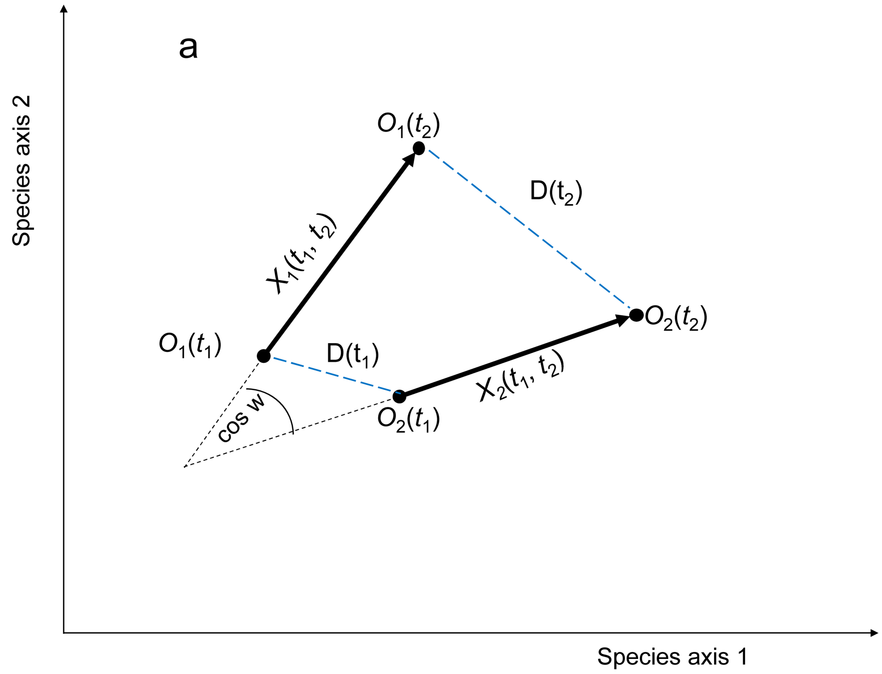
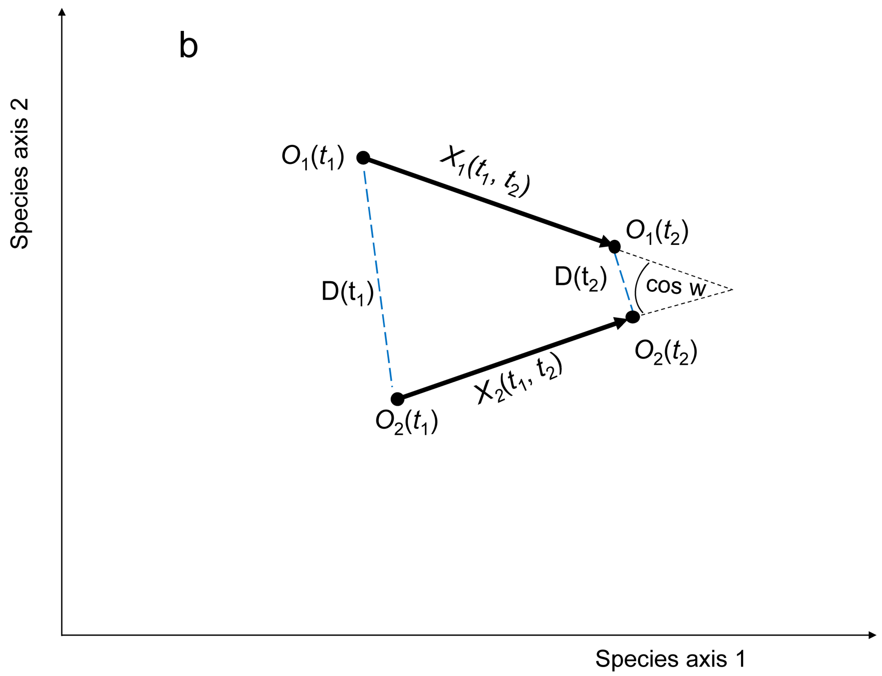

a
Species axis 2
Species axis 1
$O_1(t_2)$
$D(t_2)$
$X_1(t_1, t_2)$
$O_1(t_1)$
$D(t_1)$
$O_2(t_2)$
$X_2(t_1, t_2)$
cos w
$O_2(t_1)$


b
Species axis 2
Species axis 1
$O_1(t_1)$
$X_1(t_1, t_2)$
$O_1(t_2)$
$D(t_2)$
cos w
$D(t_1)$
$O_2(t_2)$
$X_2(t_1, t_2)$
$O_2(t_1)$

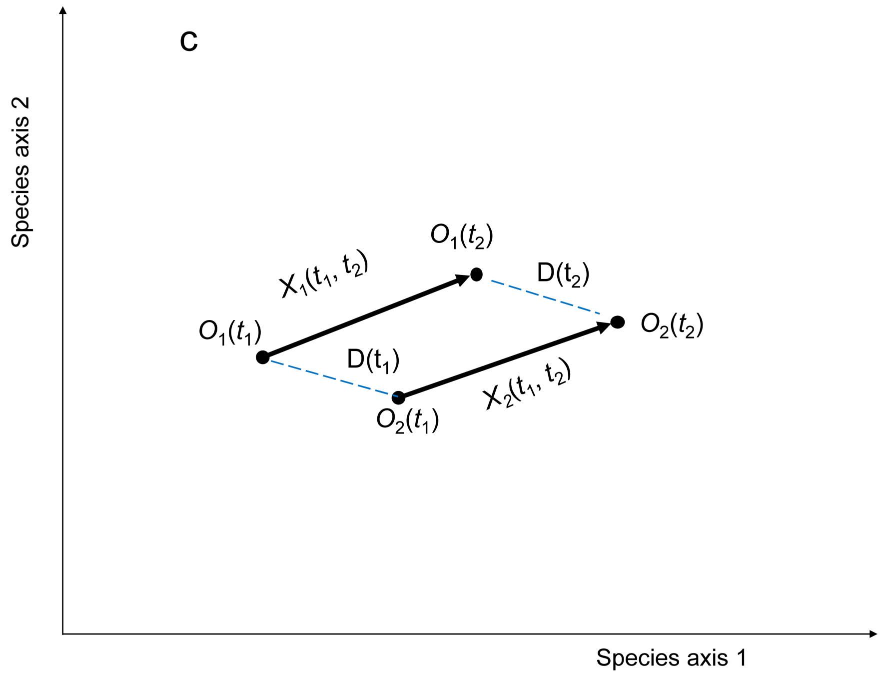
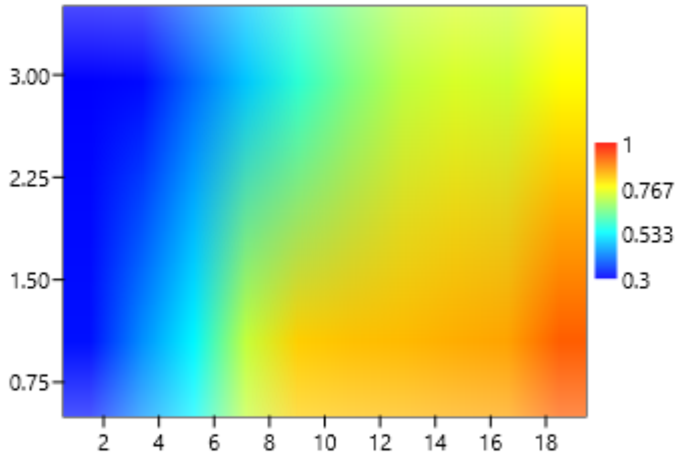
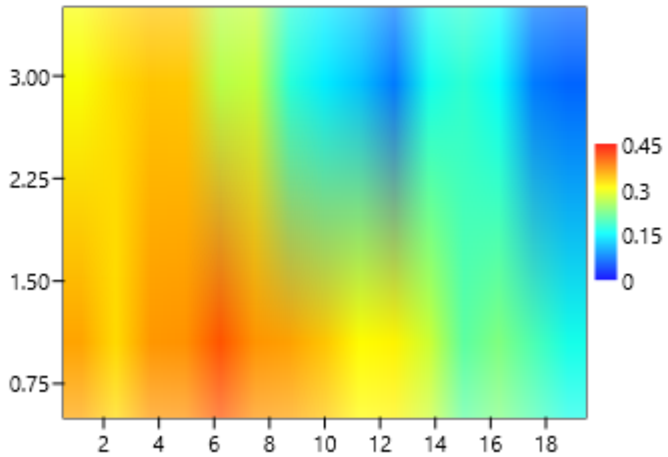


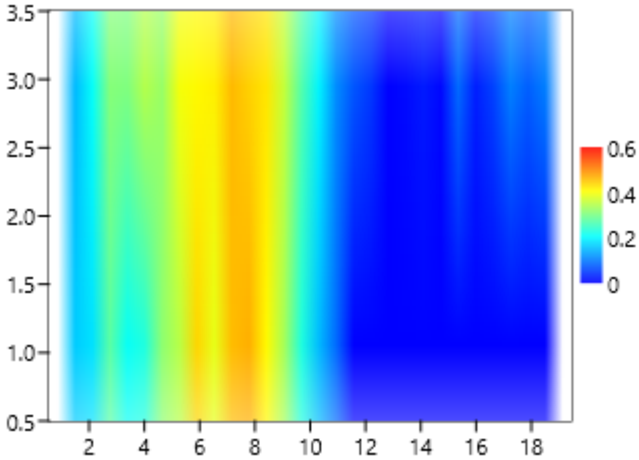
Fig. S1. Graphical examples illustrating the inconsistency between structural synchrony in two synchronously sampled communities and the divergence/convergence estimated by a similarity index. Points represent the community states *O* observed in two spatial (sites 1 and 2) at two consecutive points of time (t_1 and t_2). Structural synchrony at time interval ($t_2 - t_1$) is represented as the angle *w* between the vectors X_1 and X_2 (see text for explanation); dissimilarity between communities is represented as distances *D* between the points 1 and 2. (a,b) Equally synchronous changes in two communities (equal angles *w*) may lead to decreasing (a) or increasing (b) similarity. (c) Absolutely synchronous changes in communities (vectors X_1 and X_2 are parallel, $w = 0$) do not affect the similarity.


3.00
2.25
1.50
0.75
2
4
6
8
10
12
14
16
18
1
0.767
0.533
0.3

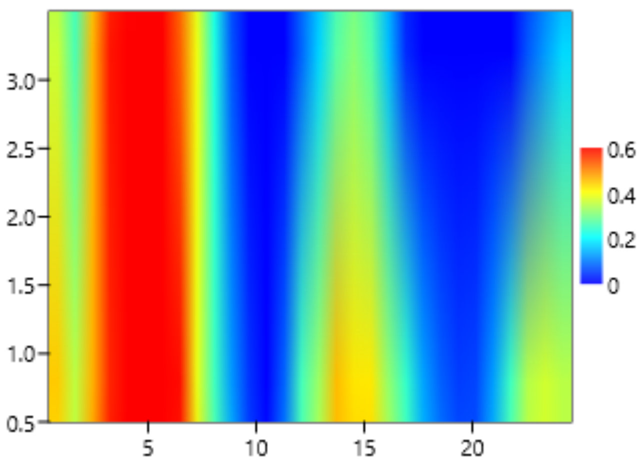
a


3.00
2.25
1.50
0.75
2
4
6
8
10
12
14
16
18
0.45
0.3
0.15
0

b



c



d

Fig. S2. Examples of synchrony maps obtained by computer simulations. (a) scenario 1 (local, spatially and temporally autocorrelated factors, a_{DEM} = a_{ENV} = 0.4, k = 0.8); (b) scenario 2 (long-term trend, a_{DEM} = a_{ENV} = 0.5, k = 0.025); (c) scenario 3 (one-time impact; a_{DEM} = 0.6, a_{ENV} = 0.3, k = 3, moment of impact T = 6); (d) scenario 4 (periodic environmental fluctuations; a_{DEM} = a_{ENV} = 1.5, phase k = –5.5, period T = 10). Degree of synchrony (W value) is denoted by color (calibrated scale is shown on the right).

Text S1. Synchrony.bas is code for structural synchrony computation. Code is written on QB64 (QuickBasic 4.5 Plus-compatible editor and C++ compiler for Windows).

Dataset parameters YEAR (year of survey, optional), S (total number of species), SAMPLE (number of sites or sampling points), T (number of sampling sessions) are set in source code heading before compilation/run.

Initial data are read from the text files (.dat) named as ABUNDANCES.dat (species absolute abundances or %), DATES.dat (dates of sampling sessions) and COORDINATES (*x*-*y* coordinates of sampling sites). These files must exist before running the code.

Results are outputted in text file W.res; each row contains Year, Time interval, Distance, and (cos *w*)-value for a pair of samples.

Code

```
' $DYNAMIC
DEFINT I-N

DIM SHARED YEAR AS INTEGER: YEAR = 2000
DIM SHARED S AS INTEGER: S = 13: 'TOTAL NUMBER OF SPECIES
DIM SHARED SAMPLE AS INTEGER: SAMPLE = 16: 'NUMBER OF SAMPLING POINTS (SITES)
DIM SHARED T AS INTEGER: T = 5: 'NUMBER OF SAMPLING SESSIONS
DIM SHARED N(S, SAMPLE, T) AS SINGLE: 'SPECIES ABUNDANCES
DIM SHARED DATE(T) AS INTEGER: 'SAMPLING DATES
DIM SHARED X(SAMPLE) AS INTEGER, Y(SAMPLE) AS SINGLE: 'SITE COORDINATES
DIM SHARED D(SAMPLE, SAMPLE) AS SINGLE: 'DISTANCES
DIM SHARED DT(T, T) AS INTEGER: 'TIME INTERVALS
DIM SHARED DN1(S) AS SINGLE, DN2(S) AS SINGLE: 'ABUNDANCE DIFFERENCES
DIM SHARED T1 AS INTEGER, T2 AS INTEGER: 'PAIRED DATES CHOSEN
DIM SHARED SA1 AS INTEGER, SA2 AS INTEGER: 'PAIRED PLOTS CHOSEN
DIM NXY AS SINGLE, NX2 AS SINGLE, NY2 AS SINGLE: 'SUMS OF DIFFERENCES
DIM SHARED COSN AS SINGLE: 'SUNCHRONY (cos w) VALUE

SCREEN 0: COLOR 15, 9
CLS

'INPUT OF INITIAL DATA
OPEN "ABUNDANCES.DAT" FOR INPUT AS #1
```

```
FOR I = 1 TO S: FOR J = 1 TO T: FOR K = 1 TO SAMPLE: INPUT #1, N(I, K, J): NEXT K: NEXT J: NEXT I
CLOSE #1

OPEN "DATES.DAT" FOR INPUT AS #3
FOR I = 1 TO T: INPUT #3, DATE(I): NEXT I
CLOSE #3

OPEN "COORDINATES.DAT" FOR INPUT AS #4
FOR I = 1 TO SAMPLE: INPUT #4, X(I), Y(I): NEXT I
CLOSE #4
FOR I = 1 TO SAMPLE: FOR J = 1 TO SAMPLE
    D(I, J) = SQR((X(I) - X(J)) ^ 2 + (Y(I) - Y(J)) ^ 2)
NEXT J: NEXT I

'SYNCHRONY CALCULATIONS
OPEN "W.RES" FOR OUTPUT AS #2
FOR T1 = 1 TO T - 1: FOR T2 = T1 + 1 TO T
    FOR SA1 = 1 TO SAMPLE - 1: FOR SA2 = SA1 + 1 TO SAMPLE
        NXY = 0: NX2 = 0: NY2 = 0
        FOR I = 1 TO S
          DN1(I) = N(I, SA1, T2) - N(I, SA1, T1)
          DN2(I) = N(I, SA2, T2) - N(I, SA2, T1)
          NXY = NXY + DN1(I) * DN2(I)
          NX2 = NX2 + (DN1(I)) ^ 2: NY2 = NY2 + (DN2(I)) ^ 2
        NEXT I

        COSN = NXY / SQR(NX2 * NY2)

        PRINT #2, USING "####"; YEAR;
        PRINT #2, "   ";
        PRINT #2, USING "####"; DT(T1, T2);
        PRINT #2, "   ";
        PRINT #2, USING "####.##"; D(SA1, SA2);
        PRINT #2, "   ";
        PRINT #2, USING "##.###"; COSN;
```

```
        PRINT #2, ""

    NEXT SA2: NEXT SA1
NEXT T2: NEXT T1

CLOSE #2
END
```