**GENERAL INFORMATION**

1. Title: The importance of facilitation on community assembly disappears under severe drought stress
2. Authors:

*Corresponding Investigator*

Name: Dr Gefei Zhang

Institution: Linze Inland River Basin Research Station, Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences, Lanzhou, China.

Email: [zhanggf@lzb.ac.cn](mailto:zhanggf@lzb.ac.cn)

*Co-investigator 1*

Name: Dr Wenzhi Zhao

Institution: Linze Inland River Basin Research Station, Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences, Lanzhou, China.

*Co-Investigator 2*

Name: Dr Xiaofen Wang

Institution: Prata cultural College, Gansu Agricultural University, Lanzhou, China.

1. Date: 2017-2019.
2. Location: 39⁰22′ - 39⁰26′ N and 100⁰06′ - 100⁰09′ E, 1380 m a.s.l. Badain Jaran Desert, Gansu, China.
3. Funding: National Natural Science Foundation of China (41771551).
4. Recommended citation: Zhang, Gefei; Zhao, Wenzhi; Xiaofen, Wang (2022), The importance of facilitation on community assembly disappears under severe drought stress, Dryad, Dataset, <https://doi.org/10.5061/dryad.2547d7wsc>.

**DATA & FILE OVERVIEW**

1. Description of dataset

This investigation was conducted in a typical desert grassland at the southern edge of the Badain Jaran Desert from 2017 to 2019. During the investigating period, summer rainfall declined from 71.4 mm in 2019 to 48.6 mm in 2017 and 25.6 mm in 2018. Through this investigation, we studied the effect of foundation plant (*Calligonum mongolicum*, shrub) on local-scale assembly process along an interannual drought gradient in water-limited communities. Species relative abundance was investigated in both under-shrub and open habitats, which can be used to measure the effect size of shrubs on local communities under different stresses. Trait distributions (i.e., community-weighted mean, trait range, trait spacing) among habitats were measured to evaluate the effect of shrubs on community assembly under different drought stresses. Additionally, the effect of shrubs on soil moisture/water content (SWC) and soil organic matter (SOM) under different drought stresses were also investigated, which can be used to determine the underlying mechanism that driving the assembly process.

1. File List

*File 1*

Name: Zhanggf\_2022\_FE\_abundance\_a.csv

Description: species abundance among different habitats in 2017.

*File 2*

Name: Zhanggf\_2022\_FE\_abundance\_b.csv

Description: species abundance among different habitats in 2018.

*File 3*

Name: Zhanggf\_2022\_FE\_abundance\_c.csv

Description: species abundance among different habitats in 2019.

*File 4*

Name: Zhanggf\_2022\_FE\_soil\_a.csv

Description: the shrub’s effect size on SWC and SOM under different stresses.

*File 5*

Name: Zhanggf\_2022\_FE\_soil\_b.csv

Description: the heterogeneity of SWC and SOM among different habitats and years.

*File 6*

Name: Zhanggf\_2022\_FE\_diversity\_a.csv

Description: gamma diversity among different habitats and years.

*File 7*

Name: Zhanggf\_2022\_FE\_diversity\_b.csv

Description: alpha diversity among different habitats and years.

*File 8*

Name: Zhanggf\_2022\_FE\_trait\_a.csv

Description: community-weighted means among different habitats and years.

*File 9*

Name: Zhanggf\_2022\_FE\_trait\_b.csv

Description: trait ranges among different habitats and years.

*File 10*

Name: Zhanggf\_2022\_FE\_trait\_c.csv

Description: trait spacing among different habitats and years.

**METHODOLOGICAL INFORMATION**

To measure species relative abundance, a single 2 m × 2 m quadrat was established beneath the canopy of stand-alone *Calligonum mongolicum*, while another quadrat of the same size was placed in an open area. In these quadrats, species was identified, and the species-specific abundance was recorded.

To measure functional traits at different years and habitats, we randomly selected 2-5 adult individuals for every observed understory species according to their abundance in each selected quadrat at both habitats. Five species were omitted from the analyses because they were too rare to accurately estimate trait values. To obtain robust estimation, more than 30 individuals for each species were sampled in different years and habitats. When the suitable samples of a species did not reach this amount, we randomly collected additional individuals from the same habitats in the fenced plots.

Lateral spread (cm) was measured as the maximum crown width of individuals in the understory community. Height (cm) was measured as the distance between the extended upper boundary of the crown and the ground level. SLA (cm∙g-1) was determined as the ratio of fresh leaf area to leaf dry mass. LDMC (mg∙g-1) was determined as the ratio of leaf dry mass to fully rehydrated fresh mass.

To measure soil moisture/water content (SWC), we collected four soil cores (5 cm diameter, 10–20 cm in depth) along the diagonal of each quadrat, and determined them gravimetrically after oven-drying for 48 h at 110°C.

To measure soil organic matter (SOM), we randomly chose 10 pairwise quadrats each year, collected four soil cores within each quadrat, and applied the dichromate oxidation method.

**DATA-SPECIFIC INFORMATION**

*File 1* - Zhanggf\_2022\_FE\_abundance\_a.csv:

1. Number of variables: 14

2. Number of cases/rows: 80

3. Variable List:

Habitats: different microhabitats.

N\_quadrat: sequence number of the pairwise quadrat.

Variable 3-14: identified species in quadrats.

4. Missing data codes:

None

5. Abbreviations used:

uc: under-shrub habitat.

oa: open-area habitat.

6. Other relevant information:

*Bassia dasyphylla, Salsola ruthenica, Halogeton arachnoideus, Agriophyllum squarrosum, Corispermum mongolicum, Artemisia fridida, and Zygophyllum fabago* are forbs*; Chloris virgata and Eragrostis Pilosa* are grasses*; Haloxylon ammodendron, Nitraria shpaerocarpa, and Reaumuria soongarica* are shrubs.

*File 2* - Zhanggf\_2022\_FE\_abundance\_b.csv:

1. Number of variables: 14

2. Number of cases/rows: 90

3. Variable List:

Habitats: different microhabitats.

N\_quadrat: sequence number of the pairwise quadrat.

Variable 3-14: identified species in quadrats.

4. Missing data codes:

None

5. Abbreviations used:

uc: under-shrub habitat.

oa: open-area habitat.

6. Other relevant information:

*Bassia dasyphylla, Salsola ruthenica, Halogeton arachnoideus, Agriophyllum squarrosum, Corispermum mongolicum, Artemisia fridida, and Zygophyllum fabago* are forbs*; Chloris virgata and Eragrostis Pilosa* are grasses*; Haloxylon ammodendron,* *Nitraria shpaerocarpa, and* *Reaumuria soongarica* are shrubs.

*File 3* - Zhanggf\_2022\_FE\_abundance\_c.csv:

1. Number of variables: 14

2. Number of cases/rows: 78

3. Variable List:

Habitats: different microhabitats.

N\_quadrat: sequence number of the pairwise quadrat.

Variable 3-14: identified species in quadrats.

4. Missing data codes:

None

5. Abbreviations used:

uc: under-shrub habitat.

oa: open-area habitat.

6. Other relevant information:

*Bassia dasyphylla, Salsola ruthenica, Halogeton arachnoideus, Agriophyllum squarrosum, Corispermum mongolicum, Artemisia fridida, and Zygophyllum fabago* are forbs*; Chloris virgata and Eragrostis Pilosa* are grasses*; Haloxylon ammodendron, Nitraria shpaerocarpa, and Reaumuria soongarica* are shrubs.

*File 4* - Zhanggf\_2022\_FE\_soil\_a.csv:

1. Number of variables: 3

2. Number of cases/rows: 24000

3. Variable List:

Stress\_levels: different drought stress levels.

Soil\_ properties: target soil properties.

Effect\_size: The effect size of shrubs on microenvironments.

4. Missing data codes:

None

5. Abbreviations used:

D: low drought stress, 2019.

D+: median drought stress, 2017.

D++: strong drought stress, 2018.

SWC: soil moisture content.

SOM: soil organic matter.

6. Other relevant information:

The shrub effect size () on SWC and SOM in the *i*-th year was measured from:

where is the value of SWC or SOM in *k*-th sample.

*File 5*- Zhanggf\_2022\_FE\_soil\_b.csv:

1. Number of variables: 4

2. Number of cases/rows: 48000

3. Variable List:

Stress\_levels: different drought stress levels.

Habitats: different microhabitats.

Soil\_ properties: target soil properties.

Heterogeneity: The heterogeneity of microenvironments.

4. Missing data codes:

None

5. Abbreviations used:

D: low drought stress, 2019.

D+: median drought stress, 2017.

D++: strong drought stress, 2018.

SWC: soil moisture content.

SOM: soil organic matter.

6. Other relevant information:

The heterogeneity () of SWC and SOM in the *i*-th year and *j*-th sample was measured from:

where is the value of SWC or SOM in *k*-th sample.

*File 6* - Zhanggf\_2022\_FE\_diversity\_a.csv:

1. Number of variables: 3

2. Number of cases/rows: 24000

3. Variable List:

Stress\_levels: different drought stress levels.

Habitats: different microhabitats.

Gamma\_D: gamma diversity in pooled communities.

4. Missing data codes:

None

5. Abbreviations used:

D: low drought stress, 2019.

D+: median drought stress, 2017.

D++: strong drought stress, 2018.

6. Other relevant information:

Gamma diversity () in the *K* samples was calculated from:

The relative abundance for *i*-th species at the community level was derived from . The vector was estimated from:

*File 7* - Zhanggf\_2022\_FE\_diversity\_b.csv:

1. Number of variables: 3

2. Number of cases/rows: 24000

3. Variable List:

Stress\_levels: different drought stress levels.

Habitats: different microhabitats.

Alpha\_D: alpha diversity in local communities.

4. Missing data codes:

None

5. Abbreviations used:

D: low drought stress, 2019.

D+: median drought stress, 2017.

D++: strong drought stress, 2018.

6. Other relevant information:

Alpha diversity in the *K* samples was calculated as:

The relative abundance for *i*-th species in *k*-th sample was derived from . The vector was estimated from:

*File 8* - Zhanggf\_2022\_FE\_trait\_a.csv:

1. Number of variables: 4

2. Number of cases/rows: 96000

3. Variable List:

Stress\_levels: different drought stress levels.

Habitats: different microhabitats.

Trait: target functional traits.

CWM: community-weighted means.

4. Missing data codes:

None

5. Abbreviations used:

D: low drought stress, 2019.

D+: median drought stress, 2017.

D++: strong drought stress, 2018.

SLA: specific leaf area (m∙g-1).

LDMC: leaf dry matter content (mg∙g-1).

LS: lateral spread (cm).

H: height (cm).

6. Other relevant information:

Community-weighted means (CWM) for the *t*-th trait was calculated as:

where the species relative abundance was estimated from , the expected values of functional traits (i.e., SLA, LDMC, LS, H) at the community scale were estimated from:

*File 9* - Zhanggf\_2022\_FE\_trait\_b.csv:

1. Number of variables: 4

2. Number of cases/rows: 96000

3. Variable List:

Stress\_levels: different drought stress levels.

Habitats: different microhabitats.

Trait: target functional traits.

TR: trait ranges.

4. Missing data codes:

None

5. Abbreviations used:

D: low drought stress, 2019.

D+: median drought stress, 2017.

D++: strong drought stress, 2018.

SLA: specific leaf area (m∙g-1).

LDMC: leaf dry matter content (mg∙g-1).

LS: lateral spread (cm).

H: height (cm).

6. Other relevant information:

Trait ranges (R) for the *t*-the trait was calculated as:

where the expected trait values () at the community scale and the intracommunity average () for the *t*-th trait were estimated from:

*File 10* - Zhanggf\_2022\_FE\_trait\_c.csv:

1. Number of variables: 4

2. Number of cases/rows: 96000

3. Variable List:

Stress\_levels: different drought stress levels.

Habitats: different microhabitats.

Trait: target functional traits.

TS: trait spacing.

4. Missing data codes:

None

5. Abbreviations used:

D: low drought stress, 2019.

D+: median drought stress, 2017.

D++: strong drought stress, 2018.

SLA: specific leaf area (m∙g-1).

LDMC: leaf dry matter content (mg∙g-1).

LS: lateral spread (cm).

H: height (cm).

6. Other relevant information:

Trait spacing (T) for *t*-the trait was calculated as:

where the intraspecies trait variation () at the community scale and intracommunity trait variation () for the *t*-the trait were estimated from: