BioCrust 3

2016

Third International Conference on Biological Soil Crusts
Moab • Utah • USA
September 26–30

Agenda & Program




nau.edu/merriam-powell/BioCrust3

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Healthy soil biocrust community with wind-eroded rock formations in the background. (Photo credit: Bill Bowman)

Proud sponsor of BioCrust 3!

The Southwest Biological Science Center (SBSC) has field offices in Arizona (Flagstaff and Tucson) and Utah (Moab) and conducts research on the biology and ecology of the Colorado Plateau as well as in the Sonoran, Chihuahuan, and Mojave Desert riverine and upland landscapes. The Terrestrial Dryland Ecology (TDE) branch of SBSC focuses on the drylands of the Southwest. In addition to generating world-renowned research on the biology and ecology of biocrusts, TDE scientists study the wildlife, plants, and soils in drylands and how they may be affected by droughts, future climates, and specific disturbances such as wildfires, invasive species, and energy development. The SBSC also contains the River Ecosystem Science (RES) branch, and RES scientists study native and nonnative fishes, aquatic insects, and sediment movement in the rivers of the Southwest. The effects of Glen Canyon Dam operations on Colorado River resources is a major focus of the RES. As a whole, terrestrial and aquatic research conducted by the SBSC improves our understanding of ecosystem function in our region, and informs and provides science support for resource managers in the Southwest, other parts of the United States, and in other countries.

You can also find us at the U.S. Geological Survey booth

BIOCRUST3

3rd International Workshop on Biological Soil Crusts

Third International Workshop on Biological Soil Crusts

September 26-30, 2016
Star Hall • Moab, Utah, USA

Agenda & Program

The following Northern Arizona University entities generously provided support: School of Forestry; Office of the Vice President for Research; Office of the Provost; College of Engineering, Forestry, and Natural Sciences; School of Earth Sciences and Environmental Sustainability; and Merriam-Powell Center for Environmental Research.

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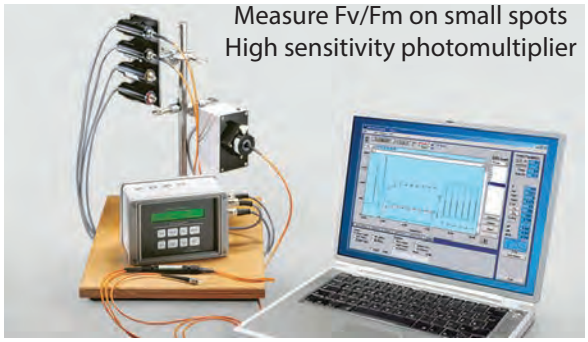

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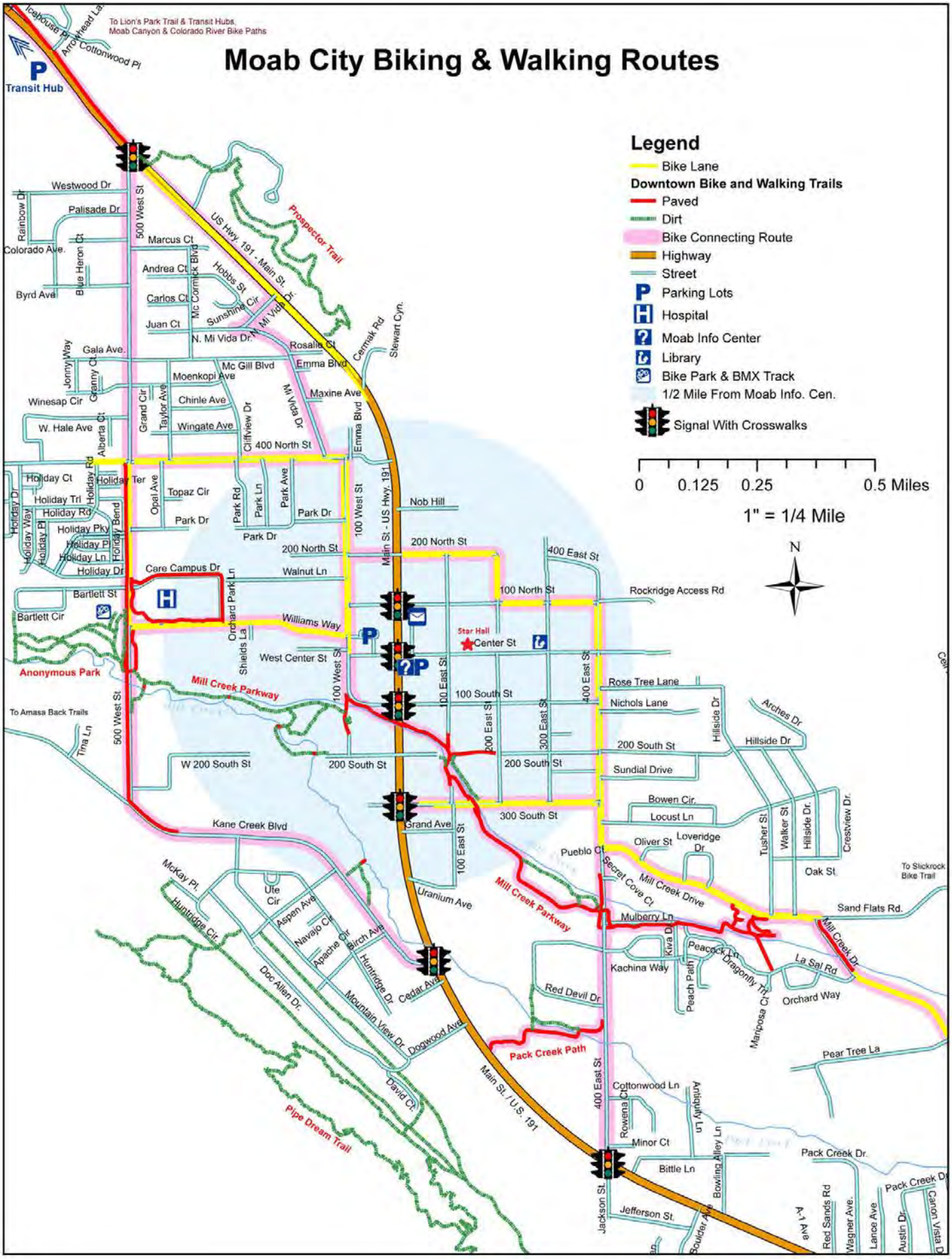
Welcome to the Third International Workshop on Biological Soil Crusts (Biocrust3)!

The International Workshop on Biological Soil Crusts provides a global forum to exchange discoveries and ideas about biocrusts. It is our great pleasure to welcome you to the third workshop of this kind. The way we have organized the conference is designed to bring together a wide range of disciplines, to cut across traditional hierarchical divisions of science, and to provide a venue where biocrust geneticists, taxonomists, physiologists, ecologists, inoculum producers, and land managers can share insights about one of the most widespread and fascinating groups of organisms on Earth.

Biocrusts are like a living skin of the Earth, composed of many distinct organisms regulating ecosystem processes, and serving as a modern analog for some of the earliest ecological communities on land. As a whole, biocrusts represent a complex consortium of organisms that structures soils and defines ecosystem properties. Biocrusts have long been recognized for their key roles in creating soil stability and their interactions with vascular plants, but increasingly, biocrusts are recognized for their role in moving water, carbon, nutrients, and energy through ecosystems. Biocrusts are at the interface between the atmosphere and mineral soils. In this regard they integrate the biotic and abiotic components of systems, and based on their importance in helping to determine ecosystem structure and function, the desire to understand and restore biocrusts has continued to expand.

Biocrust3 is truly a global conference for a growing international community of scientists and resource managers. Approximately 150 people, including presenters from 21 countries (and 10 US states), and many land managers will join together for a week of scientific and social exchanges. We can expect to learn about exciting new discoveries and also reflect on the wisdom of past and present "giants" in the field of biocrust science. This emersion of knowledge will help catalyze new ways of thinking and advance our abilities to study and understand biocrusts across scales, as well as to use this understanding in the management of our landscapes. We thank you for coming and hope that Biocrust3 will inspire you and provide many opportunities for future research and management collaborations.

Biocrust3 Co-organizers: Matt Bowker and Sasha Reed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General Information

Historic Star Hall
159 E. Center St.
Moab, UT 84532

Built in 1905, Star Hall is a historic building located in the heart of downtown Moab is the site of BioCrust3. The building, which is owned by Grand County, Utah, has been beautifully restored and is now used for films, plays, concerts, festivals, and events. **No food or drink are allowed in Star Hall, with the exception of water** because of its uniqueness and the effort put into restoring and maintaining it.

Parking: Convenient free conference parking is available in front of Star Hall, located at 159 E. Center Street, or at the nearby Moab Information Center, 25 E. Center Street.

Opening Reception: The opening reception will take place at Eddie McStiff's Bar and Restaurant in the private reception room at the rear of the restaurant. Located at 57 S. Main Street, the restaurant down the street from Star Hall.

Poster Session: The poster session will be hosted at the Moab Arts & Recreation Center, or MARC, at 111 E. 100 N., which is also walking distance from Star Hall.

Registration

Registration will take place in the lobby of the Star Hall and will be open at the following times:

Monday, September 26	8:00 AM – 5:00 PM
Tuesday, September 27	8:30 AM – 3:00 PM

Special Thanks

The conference organizers would like to thank all of the people who organized special sessions, talks, and posters for Third International Workshop on Biological Soil Crusts. Our deepest thanks go to the conference sponsors for their generous financial support!!

BioCrust3 Sponsors

The following Northern Arizona University entities generously provided support: School of Forestry; Office of the Vice President for Research; Office of the Provost; College of Engineering, Forestry, and Natural Sciences; School of Earth Sciences and Environmental Sustainability; and Merriam-Powell Center for Environmental Research.

Conference Planning & Organization

Conference Chairs

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School of Forestry
Northern Arizona University

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Southwest Biological Science Center
U.S. Geological Survey

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BIOCRUST3
3rd International Workshop on Biological Soil Crusts

September 26 – 30, 2016 • Star Hall - Moab, Utah, USA

Monday, September 26, 2016

8:00 AM Registration and Light Breakfast Refreshments

9:00 AM **Welcome: Sasha Reed**, U.S. Geological Survey, USA, and **Matthew Bowker**, Northern Arizona University, USA

9:20 AM Reflections on a life: the awesomeness of studying biocrusts, **Jayne Belnap**, U.S. Geological Survey, USA

9:50 AM **Break**

10:00 AM **Plenary 1:** Biological soil crusts: new findings, knowledge gaps, new directions, **Bettina Weber**, B. Büdel, J. Belnap. Max Planck Institute for Chemistry, Germany

Contributed Session 1 – Part 1

10:50 AM **Eldridge D.J.** and S. Soliveres. Are shrub cover and grazing effects on biocrust richness mediated by soil heterogeneity and/or intransitivity?

11:05 AM **McCune B.** and J. Di Meglio. Up against the wall of lichen biodiversity in soil crusts: the case of *Aspicilia* in the Columbia Basin

11:20 AM **Durham R.A.**, M.E. DuPre, K.D. Doherty, A.J. Antoninka, and M.A. Bowker. Insolation and disturbance history drives biocrust biodiversity in western Montana rangelands

11:35 AM **Saha, D., C.B. Pandey, S. Kumar.** Species composition, distribution patterns of biological soil crusts in varied geomorphic units of Jaisalmer district of Indian Thar Desert

11:50 AM **Havrilla C.A.** and N.N. Barger. The role of biocrusts in regulating grass germination and establishment

Lunch – On Your Own (12:05 to 1:30 PM)

Contributed Session 1 – Part 2

1:30 PM **Moger-Reischer R.Z.**, Y.A. Chung, and J.A. Rudgers. Interactions among *Bouteloua* grasses, soil type, moisture, and crust cyanobacteria in the Chihuahuan Desert grassland

1:45 PM **Dettweiler-Robinson E.**, J. Rudgers, and B. Sinsabaugh. Plant-biocrust-fungal interactions in arid lands: primary producer competition and microbial facilitation.

2:00 PM **Root H.T.**, J.C. Brinda, and E.K. Dodson. Lichen and bryophyte biotic soil crust recovery 12-16 years following wildfire in Idaho, USA

2:15 PM **Glaser K.**, K. Baumann, P. Leinweber, and U. Karsten. Linking biological soil crust diversity to ecological functions

2:30 PM **Truscott T.**, Z. Pan, W.G. Pitt, Y. Zhang, N. Wu, and Y. Tao. The upside-down water collection system of *Syntrichia caninervis*

2:45 PM **Rozenstein O.**, E. Zaady, I. Katra, A. Karnieli, J. Adamowski, H. Yizhaq. The effect of sand grain size on the development of cyanobacterial biocrusts

3:00 PM **Oren N.**, H. Raanan, O. Murik, Y. Shotland, N. Keren, S.M. Bercowicz, and A. Kaplan. What distinguishes those that can from those that can't: the desiccation tolerance of biological sand crust-inhabiting cyanobacteria

3:15 PM **Raanan H.**, N. Oren, O. Murik, Y. Shotland, N. Keren, S.M. Bercowicz, and A. Kaplan. Adaptation of microorganisms to harsh soil crust conditions: experimental and genomic approaches

3:30 PM **Break**

Early Career Showcase

3:50 PM **Introduction to early career showcase**

3:55 PM **Baughman J.T.**, K. Millette, and K.M. Fisher. Desert terraria: characterization of a Mojave Desert moss community under quartz rocks

4:03 PM **Machado de Lima N.M.**, S. Velasco Ayuso, V.M.C. Fernandes, D.W. Roush. L.H. Zanini Branco, and F. Garcia-Pichel. Diversity and ecology of cyanobacteria of biological soil crusts in Brazilian savannah

4:11 PM **Young K.E.**, H.S. Grover, and M.A. Bowker. Can and should we merge our ecosystem rehabilitation efforts with assisted migration of biocrusts?

4:19 PM **McIntyre C.L.**, S. Archer, and J. Belnap. Influence of biocrusts on grass germination and establishment in two North American deserts

4:27 PM **Chilton A.M.**, J.N. Woodhouse, and B.A. Neilan. Microbial community changes over successional stages of Australian biocrusts

4:35 PM **Dulić T.**, Z. Svirčev, J. Meriluoto, N. Vuković, and S. Teslić. The BLOCDUST model—the role of cyanobacteria-dominated biocrusts in the loess sediment formation: current state and future perspectives

4:43 PM **Mugnai G.**, F. Rossi, V.J.M.N.L. Felde, C. Viti, R. De Philippis. Effect of inoculated cyanobacteria on the structure and development of induced biological soil crust

4:51 PM **Rengifo M.C.**, and C. Arana. Effects of natural disturbances of biological soil crust on moisture retention in fog oasis of the Peruvian desert

5:15 PM **Welcome Reception**: Eddie McStiff's Brewery (Hot appetizers and no-host bar)

Tuesday, September 27, 2016

8:00 AM Registration and Light Breakfast Refreshments

9:00 AM **New Phytologist Climate Change Symposium** - Co-Chairs: **Manuel Delgado Baquerizo**, University of Colorado, Boulder, USA, and **Scott Ferrenberg**, U.S. Geological Survey, USA

9:00 AM **Plenary 2:** Biocrusts as modulators of ecosystem responses to climate change in drylands, **Fernando Maestre**, Universidad Rey Juan Carlos, Spain

9:50 AM **Break**

10:00 AM **Ferrenberg S.,** C. Tucker, R. Reibold, A. Howell, S.C. Reed. Interactions among biocrust community states and warming temperatures could drastically reduce dryland soil fertility

10:15 AM **Delgado-Baquerizo M.**, D.J. Eldridge, Y.-R. Liu, F.T. Maestre, M.A. Bowker, and B.K. Singh. Biocrusts mitigate the negative impacts of climate change on soil microbial communities and multifunctionality in terrestrial ecosystems

10:30 AM **Darrouzet-Nardi A.**, S.C. Reed, E.E. Grote, and J. Belnap. Effects of warming and watering-induced moss death on CO_2 exchange in biocrust soils over an 8-year period

10:45 AM **Fernandes V.M.C.**, D. Roush, N.M. Machado de Lima, S.L. Collins, J. Rudgers, and F. Garcia-Pichel. Cyanobacteria response to extreme drought in hot desert biocrusts

11:00 AM **Raggio J.**, T.G. Allan Green, L.G. Sancho, A. Pintado, C. Colesie, B. Weber, and B. Büdel. Metabolic activity is strongly linked to environmental factors in biological soil crusts across Europe

11:15 AM **Rutherford W.A.**, T.H. Painter, S. Ferrenberg, J. Belnap, G.S. Okin, C. Flagg, and S.C. Reed. The energy of biocrusts: how climate change disturbances in drylands may induce large, novel global climate change feedbacks

11:30 AM **Tucker C.T.**, S. Ferrenberg, and S.C. Reed. Warming results in accelerated carbon loss from biological soil crust and soils in greenhouse mesocosms

11:45 AM **Zaady** E., Y. Knoll, and S. Shuker. The role of cyanobacterial crusts, as an ecosystem engineer, on survival of planted trees during severe drought

Lunch – On Your Own (12:00 to 1:30 PM)

Mixed Standard & Lightning Talks 1

1:30 PM Yin, B.F., **X.B. Zhou**, Y.M. Zhang. Ecological and Physiological Adaptability of *Syntrichia caninervis* Mitt in Different Microhabitats of a Temperate Desert

1:45 PM **Williams W.**, and B. Büdel. Cyanobacterial diversity and abundance facilitates increases in bioavailable N in the northern Australian savannah

1:53 PM **Jia R.L.**, L.C. Liu, Y.H. Gao, R. Hui R., H.T. Yang, and Z.R. Wang. Mutual antagonistic effect between drought and sand burial enables crust moss *Bryum argenteum* survive the two co-occurring stressors in a temperate desert, China

2:01 PM **Cano Díaz C.**, P. Mateo, M. Delgado-Baquerizo, and F.T. Maestre. Climate change interactions alter the abundance of cyanobacteria in a semiarid grassland

2:09 PM **Fischer T.**, L.S. Mykhailova, and T. Raab. Characterization of hydrological regimes of moss and algal biocrusts under temperate climate using multispectral imagery

Poster Session 1: *Moab Arts & Recreation Center* (2:30–3:30 PM) (Refreshments will be served)

Baldauf S., F.T. Maestre, B. Tietjen. Multiscale effects of biological soil crusts on dryland hydrology – a modeling framework to assess the impacts of global change

Concostrina-Zubiri L., C. Branquinho, **M.A. Bowker**, R. Cruz de Carvalho, P. Giordani, J. Marques da Silva, P. Matos, I. Molla, and E. Velizarova. Functional diversity of biocrusts in drylands: from ecological indicators to ecosystem services contribution

Hamdi-Aïssa B., A. Kaboul, S. et Mehda, M. Oustani, and M. Hadj-Mahammed. Endo/epilithic biological soil crust in the Sahara desert petrogypsic horizons: a micromorphological approach

Korfhage J., N. Pietrasiak, J.R. Johansen, and P. DeLey. Tardigrades display preferential grazing of soil algae

Liu L., R. Hui. And M. Xie. Effects of snowfall on carbon exchange of biocrusts and the physiological and biochemical characteristics of their micro-organisms from desert biocrusts

Morales-Sánchez D., E. Huber-Sannwald, R.L. Riego-Ruiz, N.E. López-Lozano, V.M. Reyes-Gómez, and D.R. Smart. Differences in bacterial diversity of dark biocrusts across a gradient of disturbance by livestock grazing in semiarid grasslands of Mexico

Pombubpa N., P. De Ley, N. Pietrasiak, and J.E. Stajich. Biological soil crusts microbiome diversity at Joshua Tree National Park, Granite Mountain, and Kelso Mountain

Ruckteschler N., L. Williams, B. Büdel, and B. Weber. *Fulgensia fulgens* and *Trichostomum crispulum*: an unbalanced coexistence

Smaradottir R.B., S. Bartram, and O.S. Andresson. Nitrogen fixation in biocrusts and cryptogamic covers of cool terrestrial habitats

Tamm A., D. Wu D., N. Ruckteschler, E. Rodríguez-Caballero, J. Steinkamp, H. Meusel, W. Elbert, T. Behrendt, M. Sörgel, Y. Cheng, P.J. Crutzen, H. Su, R.M.M. Abed, U. Pöschl, and B. Weber. Biological soil crusts emit large amounts of reactive nitrogen gases affecting the nitrogen cycle in drylands

Contributed Session 2

3:50 PM **Sancho L.G.**, T.G.A. Green, and A. Pintado. Late-lying snow dramatically disrupted lichen colonization process in the maritime Antarctic

4:05 PM **Zhang Y.**, X. Zhou, and B. Yin. The effects of simulated nitrogen deposition on growth and photosynthetic physiology of three different successional biocrusts

4:20 PM **Büdel B.**, H. Reichenberger, and W. Williams. Net primary productivity of a cyanobacterial biological soil crust in Northwest Queensland, Australia

4:35 PM **Williams W.**, B. Büdel, and S. Williams. Bioavailable N linked to wet-season cyanobacterial crust breakdown and resurrection: A study from the northern Australian savannah

4:50 PM **Huber-Sannwald E.**, J. Belnap, T. Arredondo, and D.R. Smart. Biological nitrogen fixation and N flows in an arid grazed grassland ecosystem using a stable isotope approach

5:30 PM **Dinner & Career Achievement Award Ceremony** on the banks of the Colorado River, transportation provided

Wednesday, September 28, 2016

Free time and off-site excursions

Meals are on your own

Thursday, September 29, 2016

8:00 AM Registration and Light Breakfast Refreshments

9:00 AM **Ecological Restoration Symposium** – Co-chairs: **Nichole Barger**, University of Colorado Boulder, USA, and **Yunge Zhao**, Institute of Soil and Water Conservation, China

9:00 AM **Barger N.** – Introduction to Ecological Restoration Symposium

9:05 AM **Antoninka A.J.**, M.A. Bowker, P.F. Chuckran, N. Barger, and J. Belnap. Rapid culture of N-fixing soil lichens and biocrusts for rehabilitation of drylands

9:15 AM **Nelson C.**, A. Giraldo Silva, S. Velasco Ayuso, N. Barger, and F. Garcia-Pichel. Creating the seeds of restoration: two approaches to producing compositionally explicit, location-specific biological soil crusts inoculum

9:25 AM **Doherty K.**, M. Bowker, A. Antoninka, R. Durham, and H. Grover. Shades of success: propagating the dominant drylands moss genus *Syntrichia*

9:35 AM **Grover H.S.**, M.A. Bowker, and A.J. Antoninka. Rapid cultivation of "fire moss" as a potential tool for burned area emergency response

9:45 AM **Zhao Y.** Ecological adaption of moss species—the fundamental for moss crust restoration

9:55 AM **Break**

10:10 AM **Group discussion: Successes & challenges of biocrust cultivation** - Moderator: **N. Barger**, Participants: **A.J. Antoninka, C. Nelson, K. Doherty, H.S. Grover. Y. Zhao, M. Bowker, F. Garcia-Pichel, and Y.M. Zhang**

10:40 AM **Faist A.**, A.J. Antoninka, C. Nelson, A. Giraldo Silva, S. Velasco Ayuso, M.A.

Bowker, S.C. Reed, M. Duniway, F. Garcia-Pichel, J. Belnap, and N.N. Barger. Biocrust inoculum development and soil stabilization strategies to promote biocrust restoration

10:50 AM **Hu C.**, L. Shubin, W. Li, G. Hongmei, and O. Hailong. Environmental constraints of biocrustal application

11:00 AM **Reeve S.**, and D. Lipson. Improving ecosystem function: facilitating restoration of degraded biocrusts using mixed culture inoculation

11:10 AM **Zhang Z.S.**, Y.L. Chen, B.X. Xu, Y. Zhao, H.J. Tan, and X.J. Dong. Topographic differentiations of hydraulic properties induced by biological soil crusts in fixed sand dunes

11:20 **Letendre, A.,** D.S. Coxson, and K.J. Stewart. Ecological restoration of alpine environments with biocrust inoculant

11:30 AM **Group discussion: Biocrusts and restoration of ecosystem function** - Moderator: **N. Barger**, Participants: **A. Faist, C. Hu, S. Reeve, Z.S. Zhang. C. McIntyre, E. Zaady**

Lunch – On Your Own (12:00 to 1:30 PM)

Mixed Standard & Lightning Talks 2

1:30 PM **Malam Issa O**., N. Beaugendre, A. Choné, G. Alavoine, I. Bertrand, A; Bourguignon, O. Cerdan, J.-F. Desprats, F. Ehrarhdt, M. Gommeaux, C. Joulian, J. Languille, B. Marin, C. Naisse, J.L. Rajot, C. Sannier, C. Valentin. Can biological soil crusts be used as indicators of ecosystem disturbance in Sahelian zone?

1:45 PM **Duniway M.C.** Biological soil crusts and rangeland management: role for crusts in state and transition models?

2:00 PM **Seitz S.**, P. Goebes, K. Käppeler, M. Nebel, and T. Scholten. Development of biological soil crusts and their impact on soil erosion in an early successional subtropical forest ecosystem

2:15 PM **Felde V.J.M.N.L.**, S.L. Drahorad, S.M. Berkowicz, A. Kaplan, M. Hagemann, and P. Felix-Henningsen. The mechanical disturbance of biocrusts reduces soil fertility and microbial diversity in a sand dune ecosystem.

Poster Session 2: *Moab Arts & Recreation Center* (2:30–3:30 PM)

R. Li, C. Wang, Y. Zhaob, S. Yuan, B. Li, X. Li, and **C. Bu**. Rapid restoration of moss biocrusts on field slope under spray-seeding and broadcasting

Condon L.A., and D.A. Pyke. Future directions for arid land moss restoration in the Great Basin

Haynes A. Parking lots, pavements, and pollution—a review of biocrusts' life in the city

Navas Romero A.L., M.A. Herrera Moratta, and E.E. Martinez Carretero. Distribution of the biological soil crust and dominant functional groups in a system of paleodunes in the province of San Juan, Argentina

Serpe M.D. *Bromus tectorum* litter alters photosynthetic characteristics and the hydration period of biocrusts from sagebrush steppes

Sorochkina K.S., S. Velasco Ayuso, and F. Garcia-Pichel. Biological soil crust dispersal rate

Warren S.D. Natural establishment of biological soil crusts on disturbed desert landscapes

Zaady E., I. Katra, S. Shuker, Y. Knoll, and S. Sarig. Restoration of moving sand dunes with cyanobacterial crust; growth enhancement using artificial silt and clay size particles

Davenport I., and K. White. Spectral properties of cyanobacterial soil crusts, implications for detection using remote sensing

Lababpour A. Modeling and simulation of the *Microcoleus* biofilm growth on dryland soil surface

Baldarelli L.M., J.R. Johansen, N. Pietrasiak. *Nostoc* and *Mojavia* species isolated from the Atacama Desert, Chile

Lababpour A., **M. Kaviani**, and S. Mehrpooyan. An image processing method development for monitoring the cyanobacteria Microcoleus covered area

Hosseini N., A. Lababpour, N. Farrokhi, P. Derik-vand, K.A. Warren-Rhodes, and C.P. McKay. Molecular identification of microorganisms in colonized Lut desert rocks and relevance to the search for life on Mars

Contributed Session 3

3:50 PM **Rosentreter R.** Biological soil crust diversity and cheatgrass cover in six vegetation types of SW Idaho

4:05 PM **Hernandez R.R.**, M.K. Hoffacker, M.M. Murphy-Mariscal, G.C. Wu, and M.F. Allen. Solar energy development impacts on land-cover change, biological soil crusts, and protected areas

4:20 PM **Rodriguez-Caballero E.**, P. Escribano, C. Olehowski, S. Chamizo, B. Büdel, J. Hill, Y. Cantón, and B. Weber. Biocrust mapping methods and their potential applications in Earth sciences

4:35 PM **Panigada C.**, M. Rossini, E. Zaady, G. Tagliabue, M. Celesti, B. Di Mauro, S. Cogliati, R. Colombo, U. Rascher, and F. Miglietta. Remote sensing of sun induced fluorescence for biological soil crust

4:50 PM **Gypser S.**, and M. Veste. Application of chlorophyll fluorescence, CO_2 gas exchange and NDVI for the detection of spatial variances of photosynthesis of biological soil crusts on anthropogenic degraded soils

Friday, September 30, 2016

8:00 AM Registration and Light Breakfast Refreshments

9:00 AM **Molecular Frontiers Symposium** -- Co-Chairs: **Ferran Garcia-Pichel**, Arizona State University, USA, and **Zachary Aanderud**, Brigham Young University, USA

9:00 AM **Plenary 3:** Linking microbial community structure, activity and carbon cycling in biological soil crust, **Trent Northen**, Lawrence Berkeley National Laboratory, USA

9:50 AM **Break**

10:00 AM **Symposium Talks**

10:00 AM **Garcia-Pichel F.** In crusts we trust

10:15 AM **Aanderud Z.T.**, N. Wu, Y. Zhang, J. Bahr, W.W. Zhuang, and J. Belnap. Bacterial networks and fungal connections; understanding interactions among biocrusts biological constituents

10:30 AM **Lennon J.T.**, and Z.T. Aanderud. A trait-based approach to understanding the microbial moisture niche

10:45 AM **Kuske C.R.**, R.A. Mueller, J. Belnap, S.C. Reed, and L.V. Gallegos-Graves. Seasonal distribution of soil fungal and bacterial communities in seven microhabitats of an arid grassland

11:00 AM **Giraldo Silva A.**, E. Couradeau, F. De Martini, and F. Garcia-Pichel. *Microcoleus vaginatus* carries a nitrogen-fixing microbiome that can help it colonize nutrient-deficient arid substrates

11:15 AM **Williams L.**, P. Jung, M. Rippin, N. Borchhardt, B. Becker, U. Karsten, and B. Büdel. Biological soil crusts and associated cyanobacteria of Arctic, Alpine, and Antarctic regions

11:30 AM **Swenson T.L.**, U. Karaoz, R. Lau, R. Baran, and T. Northen. Linking microbial community structure, activity, and carbon cycling in biological soil crust

11:45 AM **Baughman J.T.,** A.C. Payton, A.E. Paasch, S.F. McDaniel, and K.M. Fisher. Males of the Mojave Desert moss *Syntrichia caninervis* (Pottiaceae) are rare and shy

Lunch – On Your Own (12:00 to 1:30 PM)

Mixed Standard & Lightning Talks 3

1:30 PM **Colesie C.,** M. Szyja, and B. Büdel. Secrets of success: eco-physiological traits of early successional soil crusts

1:45 PM **De Philippis R.**, A. Adessi, and F. Rossi. Complex role of the exopolysaccharidic matrix in biological soil crusts

2:00 PM **Williams W.**, A. Apan, and B. Alchin. Key landscape function indicators determined using hyperspectral reflectance in a dry sub-humid native grassland in southern Queensland, Australia

2:15 PM **Proposals for next workshop! Discussion and vote.**

3:00 PM **Farewell and departure**

Thank you and safe travels!

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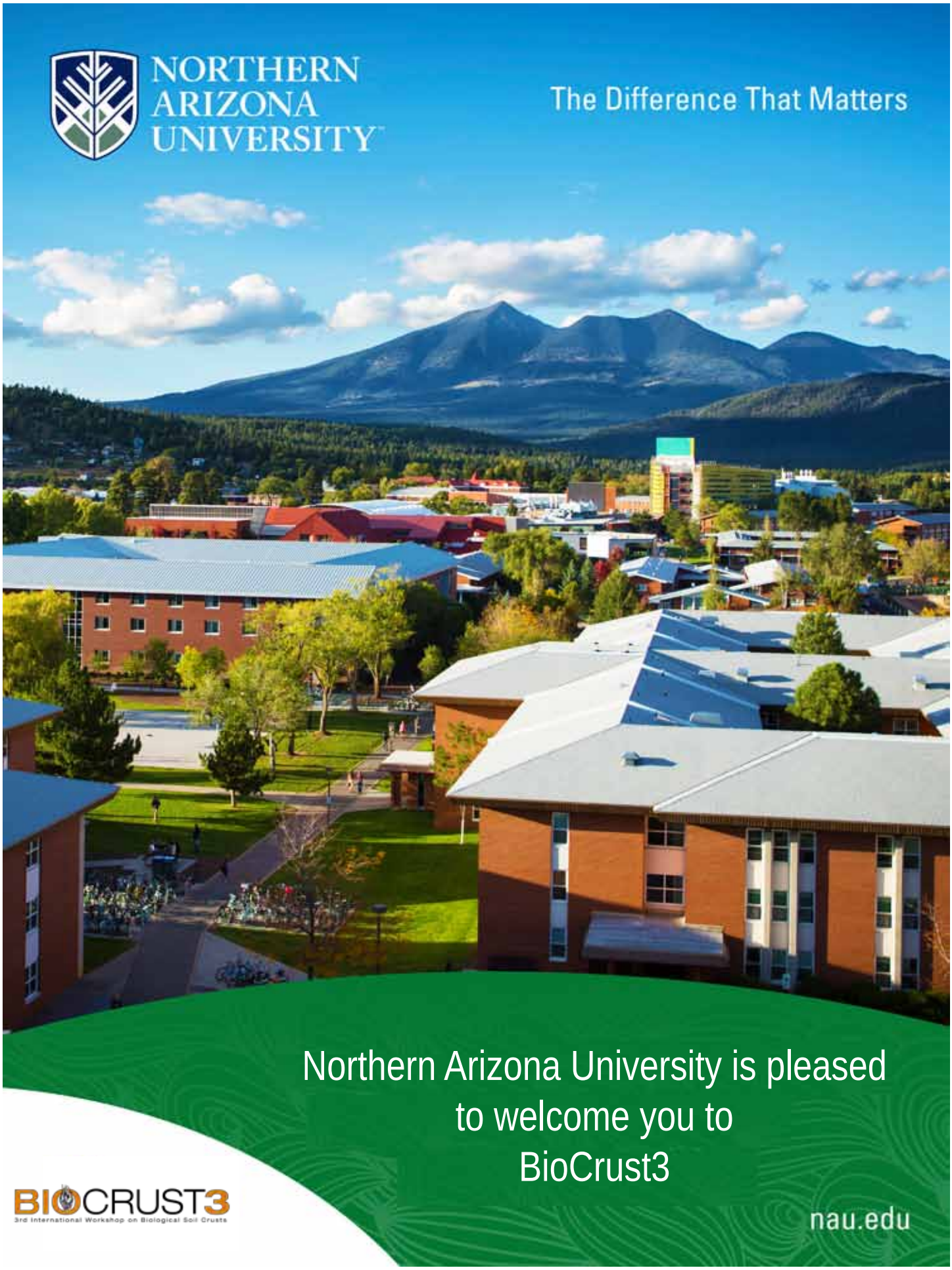
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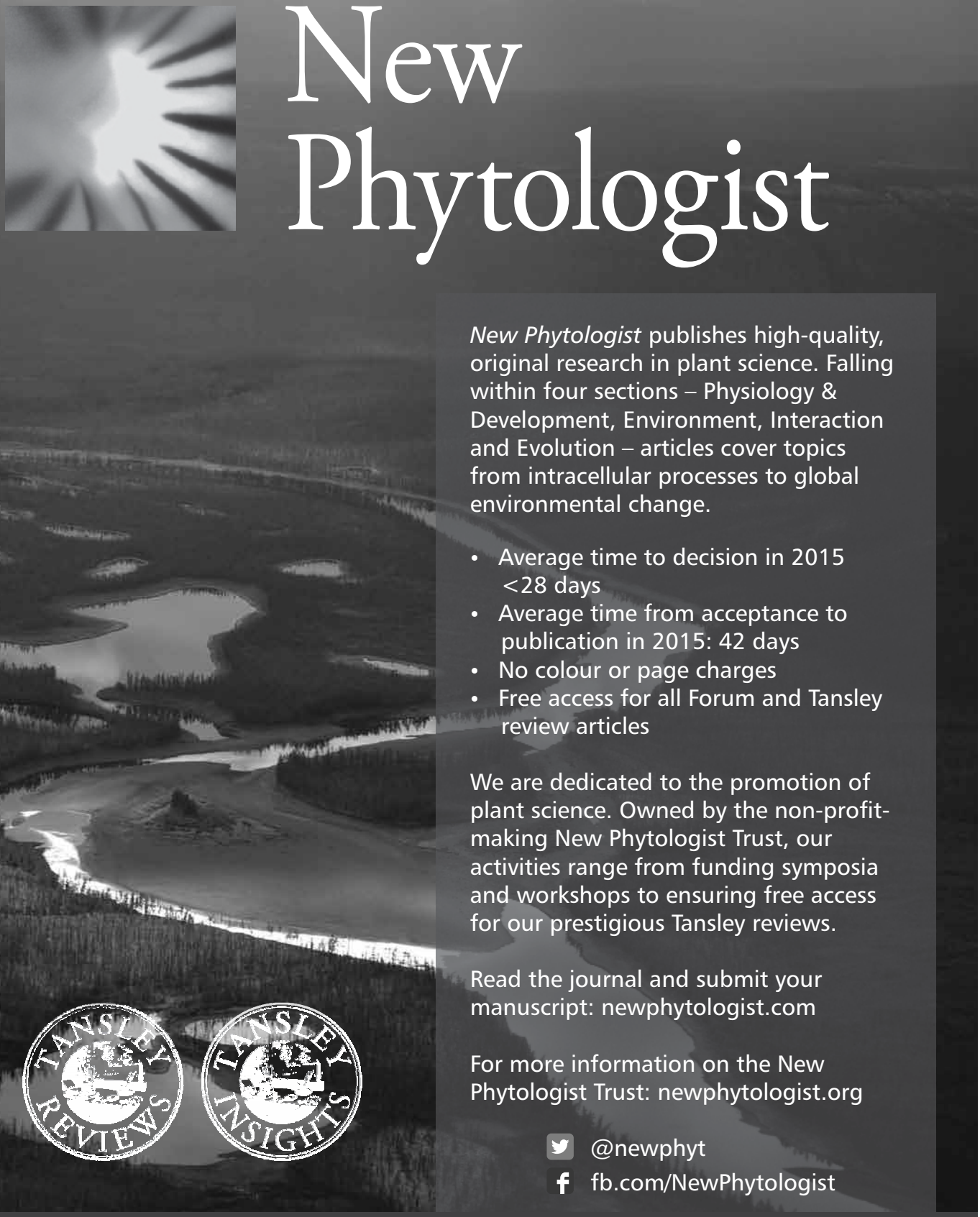

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