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Integration into plant biology and soil science has provided insights into the total environment

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ABSTRACT

The total environment includes 5 closely-linking circles, in which biosphere and lithosphere are the active core. As global population increases and urbanization process accelerates, arable land is gradually decreasing under global climate change and the pressure of various types of environmental pollution. This case is especially for China. Land is the most important resources for human beings' survival. How to increase and manage arable land is the key for sustainable agriculture development. China has extensive marshy land that can be reclaimed for the better potential land resources under the pre- condition of protecting the environment, which will be a good way for enlarging globally and managing arable land. Related studies have been conducted in China for the past 30 years and now many results with obvious practical efficiency have been obtained. For summarizing these results, salt-soil will be the main target and related contents such as nutrient transport, use types, biodiversity and interactions with plants from molecular biology to ecology will be covered, in which the interactions among biosphere, lithosphere, atmosphere and anthroposphere will be focused on.

In an ever-changing world, plant biology is of the utmost importance for securing humankind's future well-being. Plants provide oxygen, food, feed, fibers, and building materials, and are a diverse source of industrial and pharmaceutical chemicals (Li et al., 2016a, 2016b; Shao et al., 2015; Tang et al., 2015a, 2015b; Shao et al., 2016). In addition, they are centrally important to the health of ecosystems, and the management and maintenance of a sustainable biosphere necessitates their thorough understanding (Liu et al., 2015; Long et al., 2014, 2016a, 2016b; Chenchouni, 2016). Plant biology is extremely interdisciplinary, reaching from agricultural science to paleobotany to soil science and molecular physiology to ecology. It uses the latest developments in computer science, optics, molecular biology, and genomics to address challenges in model systems, agricultural crops, and ecosystems; and explores the form, function, development, diversity, reproduction, evolution, and uses of both higher and lower plants, as well as their interactions with other organisms throughout the biosphere (Shao et al., 2015; Sytar et al., 2016; Mao et al., 2016; Li et al., 2016a, 2016b; Xu et al., 2016a, 2016b, 2016c; Zhang et al., 2016) (Fig. 1).

In the invitation of Professor D. Barceló Cullerés, Co-editor in chief for the well-known leading journal, Science of the total Environment, we organized the special topic as below: Salt-soil: nutrient transport, use types, biodiversity and interactions with plants from molecular biology to ecology. We welcomes recent outstanding contributions from across the field — from single-plant to population and whole-ecosystem analyses; from molecular, to biophysical, to computational approaches; from basic to applied research; from molecular to organism-scale studies. Total 36 submissions have been received and 20 papers have been accepted after peer-reviewed process, all of which are now online or published with DOI number (see References). The following is to summarize the main results and their implications for the 20 accepted articles in the special topic.

Xu et al. (2016a, 2016b, 2016c) and Sun et al. (2016a, 2016b) applied ^{31}P NMR technique to analyze P transformation under different pyrolysis temperatures and further compared effects of biochar and P fertilizers on P availability and plant biomass, providing good reference for utilizing biochar amendment into salt-soil. Long et al. (2016a, 2016b) discussed about the current status of developing coastal mudflat areas in China by taking Yancheng, Jiangsu as an example and basing on their practical work for more than 20 years. Li et al. (2016a, 2016b), Shao et al. (2016) and Long et al. (2016a, 2016b) systemically studied the industrial multi-functional crop, Jerusalem artichoke in terms of improving sail-soil, accumulating dry matter and finely managing field, opening a new way to solve salt-soil quality by plant-centered measures. Lu et al. (2016a, b) reported the methodology of high-efficient use P, avoiding P loss and pollution in coastal zone by constructing periphyton technique. Zhang et al. (2016)and Xu et al. (2016a, 2016b, 2016c) applied molecular techniques to investigate related gene expression of important coastal crops and vegetables, providing insights

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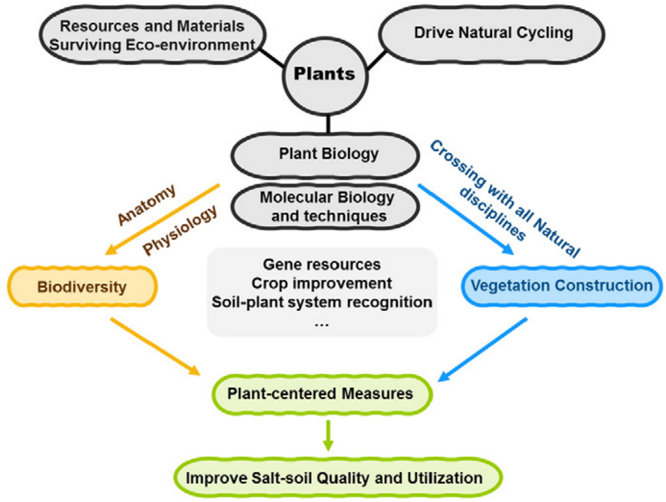

Fig. 1. Central roles of Plant Biology in the total environment.

into molecular breeding for salt-soil agriculture and sustainable use of salt-soil. Bai et al. (2016)reported the latest result by using sewage sludge as an initial fertility driver for rapid improvement of mudflat salt-soil, starting a new way for raising salt-soil fertility on large-scale with low cost. Mao et al. (2016) and He et al. (2016)studied eco-physiological characteristics of adaptable forest in the Yellow River Delta, China, further pointing out the significance for constructing stable vegetation in the region. Chenchouni (2016)established the gradient linkage between edaphic factors and inland halophytes, providing important examples for elucidating pant-soil interacting system. Sytar et al. (2016) reviewed the current status of extensive applications for phenotyping with hyperspectral imaging, which is the developing trend to monitor the process of plant and soil in vivo. All these results are of important value for sustainably utilizing salt soils. Future efforts should be focused on applying plant biology methodology, especially the modern techniques from plant molecular biology to explore new salt-resistant genes and their network under salt-soil stress and establishing a series of fine managing measures in field (Fig. 1).

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