
Behnaz Molaei

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Google Scholar: <https://scholar.google.com/citations?user=XA1lbgAAAAJ&hl=en>

RESEARCH INTERESTS

- Evapotranspiration
- Efficiency of Irrigation Systems
- Automation and Precision Irrigation
- Remote Sensing (ground/aerial system) for Irrigation Management
- Smart Irrigation Scheduling for Agricultural Water Management

EDUCATION

Washington State University, Washington, USA	<i>Biological System Engineering</i>	Ph.D., 2022
Isfahan University of Technology, Isfahan, Iran	<i>Agricultural Engineering (Irrigation & Drainage)</i>	M.Sc., 2013
Shahrekord University, Shahrekord, Iran	<i>Agricultural Water Engineering</i>	B.Sc., 2009

EMPLOYMENT HISTORY

May 2023- Present	Assistant Professor , Irrigation Engineering and Agricultural Water Management, Tennessee State University, USA
September 2022-April 2023	Postdoctoral Research Associate , AgAID, Artificial Intelligent Institute for transforming Workface & Decision Support, Center for Precision and Automated Agricultural Systems, Department of Biological System Engineering, Washington State University, WA, USA
January 2019-August 2022	Graduate Research Assistant , Department of Biological System Engineering, Washington State University, WA, USA
February 2017-December 2018	Research Assistant , Visiting Scholar, Department of Biological System Engineering, Washington State University, WA, USA
May 2013-February 2017	Co-Founder and Manager of Molaei Tissue Culture Techniques Laboratory and Greenhouse crop propagation in Molaei Agro-Industry Cooperation, Shahreza, Isfahan, Iran

HOUNRS & AWARDS

- 2022** **Best oral presentation** within Machinery Systems Technical Community at ASABE Annual International Meeting in Houston, Texas, 2022, <https://bsyse.wsu.edu/people/students/>
Award: \$250
- 2022** **Graduate Student Leadership Award**, College of Agriculture, Human, and Natural Resource Sciences, Washington State University, <https://cahnrs.wsu.edu/academics/2022-student-award-winners/>
Awarded Scholarship: \$1000
- 2022** **The Karen DePauw Leadership Award**, awarded by two different organizations: the Association for Faculty Women (AFW) and the Graduate School at Washington State University
<https://afw.wsu.edu/awards/outstanding-students-in-graduate-studies/previous-recipients/>
Awarded Scholarship: \$1000
- 2022** **College Representative of the Year**, Awarded by Graduate and Professional Students Association of Washington State University
<https://www.gpsa.wsu.edu/programs/excellence-awards/>
Awarded Scholarship: \$500
- 2022** **Outstanding Graduate Student Award**, Department of Biological Systems Engineering at Washington State University
- Arnie & Marta Kegel Fellowship (\$600 scholarship)
 - Walter and Vinnie Hinz Endowed Scholarship (\$300 scholarship)
- 2021** **Winner of 2021 Irrigation E3 Program Travel Award** to Attend the Irrigation Show and Education Week, IA-ASABE 6th Decennial National Irrigation Symposium, San Diego, California, December 6-10, 2021.
https://www.irrigation.org/IA/Workforce_Development/Irrigation_E3/Irrigation_E3_Winners/IA/Workforce_Development/Irrigation_E3/Irrigation-E3-Winners.aspx?hkey=6281d892-77a6-4c72-8d13-a1d866897f77
- 2020** Honorable Mention Group (Smart CougChard), WSU Digital Agathon 2020, organized by Microsoft and Washington State University.

SYNERGISTIC ELECTED POSITIONS AT WSU

- 2022-2023** **Committee Member of Diversity, Equity and Inclusion (DEI) in WSU-IAREC**
- **College Representative** at Graduate and Professional Student Association (GPSA) of Washington State University (WSU). Representing College of Agriculture, Human, and Natural Resources Sciences (CAHNRS).
 - **Chair and Director of GPSA Awards and Scholarship (A&S) Committee.**
- 2021-2022** **Responsibilities:**
- Leading 12 GPSA senators from different departments in CAHNRS to address grad students' issues to Dean of CAHNRS
 - Directing 7 senators from different colleges in WSU at A&S Committee
- Managing the A&S committee budget **\$35000** for one academic year to organize:
- **GPSA Dissertation Grants:** 24 research proposals reviewed; 21 proposals awarded

- **GPSA Research Expo:** 109 abstracts were reviewed by my committee, 58 were selected at the first evaluation to attend poster presentation on March 24th 2022, in Pullman. 18 posters selected at the poster presentation by faculty judges
- **GPSA Excellence Awards:** Directing fairly evaluation of 153 nominations for 10 different award categories reviewed by A&S committee.
- **GPSA Excellence Award Banquet:** Recognizing Research Expo and Excellence Award winners

Awarded Scholarship for GPSA work: \$2450 for whole academic year

2021-2022	Representative Graduate Students in the Graduate Studies Committee, Graduate School, WSU
2020-2021	Senator of Biological Systems Engineering (BSE) Department at Graduate and Professional Student Association (GPSA) in WSU, the Year 2020-2021 Awarded Scholarship: \$600 Per Year
2019-2020	President of Prosser Graduate Student Association (PGSA) Outstanding Achievement for the students in the IAREC during my leadership: <ul style="list-style-type: none"> • PGSA received GPSA Excellence Awards of the Registered Student Organization (RSO), Scholarship \$500 for the club • PGSA received the best RSO of the Year in the College of Agricultural, Human, And Natural Resource Sciences • Increasing stipend of IAREC graduate students due to the high costs of living and accommodation off-campus compared to the Pullman campus (Starting of the year 2020, the stipend of BSE students in Prosser increased by 17 steps which affect the living situation of current and future graduate students in IAREC)
2018-2019	Representative of Prosser Graduate Students in the Employee Event Committee of Irrigated Agricultural Research and Extension Center, WSU
2018-2019	Treasurer of Prosser Graduate Student Association Outstanding Achievement during my role: Fundraising \$700 for PGSA by selling the spearmint oil of my research Apply for fund from GPSA-Pullman: \$2500 per Year for social and academic activities

LEADERSHIP ROLES

2019-2023	Secretary of NRES-241 Sprinkler Irrigation, ASABE
2019	Serving as Co-moderator for NRES Technical Session at 2019 Boston Annual International Meeting of ASABE. Session 239, Advances in Irrigation Management, Moderator: Dr. Andre Daccache, Co-moderator: Behnaz Molaei

JUDGES OF THE PEER-REVIEWED JOURNALS

2020	Journal of American Society of Agricultural and Biological Engineers, NRES
2022	Computer and Electronics in Agriculture Agricultural Water Management

PUBLICATIONS: PEER REVIEWED RESEARCH

*Published Research (*Corresponding author)*

1. **Molaei, B.***, A.K. Chandel, R.T. Peters, L.R. Khot, A. Khan, F. Maureira, C.O. Stöckle. 2023. Investigating Practical Artificial Hot and Cold Reference Surfaces for Improved ET Estimation Using the UAS-METRIC Energy Balance Model. *Agricultural Water Management*. 284(30), 108346. <https://doi.org/10.1016/j.agwat.2023.108346>
2. **Molaei, B.**, R.T. Peters, L.R. Khot, C.O. Stöckle. 2022. Assessing Suitability of Auto-Selection of Hot and Cold Anchor Pixels of the UAS-METRIC Model for Developing Crop Water Use Maps, *Remote Sensing Journal, Remote Sensing-Based Evapotranspiration Models*. 14(18), 4454. <https://doi.org/10.3390/rs14184454>
3. Mohamed, A. Z., Peters, R. T., Sarwar, A., **Molaei, B.**, and McMoran, D. 2021. Impact of the Intermittency Movement of Center Pivots on Irrigation Uniformity. *Water*, 13(9), 1167; <https://doi.org/10.3390/w13091167>
4. **Molaei, B.**, A. Chandel, R.T. Peters, L.R. Khot, and J.Q. Vargas. 2022. Investigating Lodging in Spearmint with Overhead Sprinklers Compared to Drag Hoses Using the Texture Feature from Low Altitude RGB Imagery. *Information Processing in Agriculture*. 9(2): 335–341 <https://doi.org/10.1016/j.inpa.2021.02.003>
5. Chandel, A.K., L.R. Khot, **B. Molaei**, R.T. Peters, C.O. Stöckle, P. W. Jacoby. 2021. High-Resolution Spatiotemporal Water Use Mapping of Surface and Direct-Root-Zone Drip-Irrigated Grapevines Using UAS-Based Thermal and Multispectral Remote Sensing. *Remote Sensing*. 13(5), 954. <https://doi.org/10.3390/rs13050954>
6. **Molaei, B.**, R.T. Peters, Mohamed, A.Z., Sarwar, A. 2021. Large Scale Evaluation of a LEPA/LESA system compared with MESA on Spearmint and Peppermint. *Industrial Crops & Products*. 159: 113048. <https://doi.org/10.1016/j.indcrop.2020.113048>
7. Chandel, A.K., B. Molaei, L.R. Khot, R.T. Peters, C.O. Stöckle. 2020. High-Resolution Geospatial Evapotranspiration Mapping of Irrigated Field Crops Using Multispectral and Thermal Infrared Imagery with METRIC Energy Balance Model. *Drones*. 4(52); <https://doi.org/10.3390/drones4030052>
8. Vargas, J. Q., L.R. Khot, R.T. Peters, A.K. Chandel and B. Molaei. 2019. Low Orbiting Satellite and Small UAS based High-Resolution Imagery Data to Quantify Crop Lodging: A Case Study in Irrigated Mint Crop. *IEEE Geoscience and Remote Sensing Letters*. p. 1–5. [10.1109/LGRS.2019.2935830](https://doi.org/10.1109/LGRS.2019.2935830)
9. **Molaei, B.**, M. Gheysari, B. Mostafazadeh-Fard, E. Landi, M.M. Majidi. 2015. Evaluation of Yield and Yield Characteristics of Two Potato Varieties Under Sprinkler and Trickle Irrigation Systems. *JWSS*. 19 (71): 241–251. https://jstnar.iut.ac.ir/browse.php?a_id=3016&sid=1&slc_lang=en

PUBLICATIONS: EXTENSION

1. Peters, R.T., Zamora-Re, M.I., **Molaei, B.** 2021. Irrigation Water Management Strategies for Drought.
2. Peters, R.T., Neibling, H., Stroh, R., **Molaei, B.**, Mehanna, H. 2019. Low Energy Precision Application (LEPA) and Low Elevation Spray Application (LESA) Trials in the Pacific Northwest.
3. **Molaei, B.**, R.T. Peters, and I. Kisekka. 2019. Mobile Drip Irrigation (MDI) on Center Pivots in the Pacific Northwest: Issues and Opportunities. *WSU Extension Publication*.
4. Peters, R.T., **Molaei, B.**, Flury, M. 2019. Variable Rate Irrigation on Center Pivots. What Is It? Should I Invest?

PUBLICATIONS: PROFESSIONAL NEWSLETTER

1. Pickering, N., A. Chandel, L. Khot, M. Liu, R.T. Peters, S. Kadam, B. Molaei, J. Yoder, K. Rajagopalan, C. Stockle, G. Yorgey, D. Haller, M. Barber, and R. Khanal. 2021. Evapotranspiration Estimation: Comparison of Evapotranspiration Methods Used in Washington State. The Water Report. Water Rights, Water Quality, & Water Solutions in the West. 208:10-19. June 2021. Available online at <http://www.thewaterreport.com/Issues%20205%20to%20208.html>
2. Peters, R.T., and **B. Molaei**. 2020. Low-Elevation Spray Application (LESA) for Growing Potatoes. Potato Progress. Vol. 20, No. 7. <https://www.nwpotatoresearch.com/>
3. Peters, R.T., and **B. Molaei**. 2019. Center Pivot Modifications for Improved Efficiency and Mint Oil Yields on Mint. Oregon Mint Update, Spring 2019.

PUBLICATIONS: PROFESSIONAL MAGAZINE ARTICLES

1. Peters, R.T., and **B. Molaei**. 2018. A New Low in Irrigation: Low-Elevation Spray Application for Growing Potatoes. Potato Country magazine. July/August 2018 Issue. www.PotatoCountry.com

PUBLICATIONS: CONFERENCE PROCEEDINGS

1. **Molaei, B.**, R.T. Peters, A.K. Chandel, L.R. Khot, C.O. Stockle, and C. Campbell. 2021. Comparing Downwind Evapotranspiration Suppression in LESA and MESA Irrigation Systems. In *6th Decennial National Irrigation Symposium, 6-8, December 2021, San Diego, California* (p. 1). American Society of Agricultural and Biological Engineers.
2. **Molaei, B.**, M. Gheysari, B. Mostafazadeh-Fard, E. Landi, K. Molaei. 2016. Tuber yield irrigation water uses efficiency and starch content of two potato varieties as affected by drip tape and solid set irrigation systems. 2016 ASABE Annual International Meeting. 162460172. (doi:10.13031/aim.20162460172)

PRESENTATIONS/TALKS

a) Technical Conference Presentations/Abstracts (*Presenter)

1. **Molaei, B.***, A.K. Chandel, R.T. Peters, L.R. Khot, C.O. Stockle. 2022. Investigating Practical Artificial Hot and Cold Reference Surfaces for Improved ET Estimation using the UAS-METRIC Energy Balance Model. ASABE AIM, Houston, Texas (Time: 15 min, Participants: ~30)
2. **Molaei, B.***, R.T. Peters, A.K. Chandel, L.R. Khot, C.O. Stockle, and C. Campbell. 2021. Evaluation of Evapotranspiration Suppression under LESA and MESA of the Center Pivot Irrigation System. ASABE Annual International Meeting. July 12-16, 2021. (Virtual and On-Demand)
3. Peters, R.T.*, M. Barber, **B. Molaei**. 2021. Cost per drop: Cost Comparison Estimates for Various Irrigation Water Conservation Technologies. ASABE Annual International Meeting. July 12-16, 2021 (Virtual and On-Demand)
4. **Molaei, B.***, A. Chandel, R.T. Peters, L.R. Khot, and J.Q. Vargas. 2020. Crop Lodging Assessment in Irrigated Spearmint Using Low Altitude High-Resolution Imagery. ASABE Annual International Meeting. Virtual Meeting Due to Pandemic. July 12-15, 2020. (Virtual and On-Demand)
5. Chandel, A.K.*, **B. Molaei**, L.R. Khot, R.T. Peters, C.O., Stöckle. 2020. High-Resolution Geospatial Mapping of Actual Evapotranspiration Using Small UAS Based Imagery for Site-

- Specific Irrigation Management. WaterSmart Innovations Conference and Exposition 2019, Las Vegas, NV, USA (Time: 30 min, Participants: ~35)
6. **Molaei, B.***, R. T. Peters, A. K. Chandel, L. Khot, A. Khan, F. Maureira and C. Stockle. 2019. Investigating artificial hot and cold reference surfaces for estimating water use with thermal images. ASABE Annual International Meeting. Boston, MA, July 7–10, 2019. (Time: 15 min, Participants: ~ 35)
 7. Peters, R.T.* , **B. Molaei**, A. Sarwar, and A. Mohamed. 2019. Large-Scale Evaluation of a Low Energy Precision Application (LEPA) system compared to Mid Elevation Spray Application (MESA) on Spearmint and Peppermint. ASABE Annual International Meeting. Boston, MA, July 7–10, 2019. (Time: 25 min, Participants: ~ 35)
 8. Chandel, A.K.* , F. Maureira, A. Khan, **B. Molaei**, L.R. Khot, R.T. Peters and C. Stockle. 2019. Determination of albedo with a multispectral camera mounted near the surface. ASABE Annual International Meeting. Boston, MA, July 7–10, 2019. (Time: 15 min, Participants: ~ 35)
 9. Chandel, A.K.* , **B. Molaei**, L.R. Khot, R.T. Peters and C. Stockle. 2019. Low altitude high resolution remote sensing-based evapotranspiration mapping for the potato crop. ASABE Annual International Meeting. Boston, MA, July 7–10, 2019. (Time: 15 min, Participants: ~ 35)
 10. Maureira, F.* , A. Chandel, **B. Molaei**, L. R. Khot, R.T. Peters and C. Stockle. 2019. Proximal sensing of crop surface albedo with multispectral imaging sensors onboard ground-based platform. Paper No. 1901685, ASABE 2019 Annual International Meeting, Boston, MA, July 7- 11, 2019. (Time: 15 min, Participants: ~ 35)
 11. Peters, R.T.* , and **B. Molaei**. 2019. The 10 Commandments of Irrigation for Dairymen. 2019 Western Dairy Conference. Reno, NV. Feb. 26–28, 2019. Time: 25 min, Participants: ~ 100
 12. **Molaei, B.***, R.T. Peters. 2018. Scientific irrigation scheduling baseline research study in Columbia River basin. ASABE Annual International Meeting. Detroit, MI, July 29–Aug. 1st, 2018. (Time: 20 min, Participants: ~ 35)

b) *Invited Talks on behalf of my Ph.D. Supervisor (*Presenter)*

1. Peters, R.T., and **B. Molaei***. 2019. Mobile Drip Irrigation and Variable Rate Irrigation: A Review of the Existing Research, Pacific Northwest Vegetable Association Annual Conference and Trade Show, Kennewick, WA. November 20-21, 2019. (Time: 30 min, Participants: ~100)
2. Peters, R.T., and **B. Molaei***. 2018. Large Scale Evaluation of a LEPA/LESA System Compared to MESA on Spearmint and Peppermint. Proceeding of the WA State Mint Convention. Kennewick, WA. Dec. 4, 2018. (Time: 25 min, Participants: ~ 100)
3. Peters, R.T., and **B. Molaei***. 2018. Using LESAs and LEPA Drag Tubes and Their Effect on Spearmint and Peppermint Hay and Oil Yields. Proceeding of the 2018 ID State Mint Convention. Nampa, ID. Dec. 6, 2018. (Time: 25 min, Participants: ~ 100)

EXTENSION: TALKS & FIELD TOURS

1. **B. Molaei*** and other AgAID graduate students, 2022. AgAID MESA (Mathematics, Engineering, Science, Achievement) Field Trip for middle school kids to validate their Arduino soil temperature and moisture sensors. Responsibility: tour guide for two groups of students to take them to different scientific booth and stations. (Date: 10/10/2022, Time: 4 hours, Participants: ~ 40 kids with their teachers)
2. **B. Molaei*** and other AgAID students and technicians, 2022. AgAID annual review. Presenting the first year of sensor installation, and data collection in smart vineyard for AI project. Visitors, faculties and students from Pullman and Oregon State University and USDA-NIFA. (Date: 9/16/2022, Time of my presentation: 30 minutes, Participants: ~ 30 people)

3. **B. Molaei*** on behalf of R.T. Peters 2022. Irrigation Systems and Precision Irrigation Practices in Pacific Northwest. Field day at WSU-IAREC, Growers and dealers from Bayer Company and UniAgro Company from Rio Grande do Sul State in Brazil. (Date: 6/15/2022, Time: 3 hours, Participants: ~ 20)
4. **B. Molaei***, 2022. Application of UAS-based remote sensing techniques for water management. (My Ph.D. thesis) Annual Mint Field Day in WSU-IAREC, Washington Mint Growers. (Date: 6/7/2022, Time: 30 min, Participants: ~ 50)
5. **B. Molaei***, Walsh, D.B., R.T. Peters, R. Baker 2021. Nitrogen and Water Management on Spearmint. Annual Mint Field Day in WSU-IAREC, Washington Mint Growers. (Date: 6/8/2021, Time: 30 min, Participants: ~ 60)

POSTER PRESENTATION

1. **Molaei, B.** 2020. Investigating artificial hot and cold reference surfaces for estimating water use with thermal images. Abstract for GPSA Research Exposition. Online Event Due to Pandemic, COVID-19
2. **Molaei, B.** 2020. Investigating artificial hot and cold reference surfaces for estimating water use with thermal images. Abstract for the 2020 WSU Digital Agriculture Summit.
<https://research.wsu.edu/idiag/summit-abstracts/>
3. **Molaei, B.**, R.T. Peters, A.K. Chandel, L.R. Khot, A. Sarwar, A.M. Mohammed. 2019. The effect of Low Energy Precision Application on the Oil Yield & Lodging of the Peppermint & Spearmint. Poster presented at: AgTech day; Aug 22, 2019, Center for Precision and Automated Agricultural Systems, Prosser, WA, USA.
4. **Molaei, B.**, R.T. Peters, A.K. Chandel, L.R. Khot, A. Sarwar, A.M. Mohammed 2019. The effect of Low Energy Precision Application on the Oil Yield & Lodging of the Peppermint & Spearmint. *Poster presented at* AgTech day; Aug 22, 2019, Center for Precision and Automated Agricultural Systems, Prosser, WA, USA.
5. Gheysari, M., **B. Molaei**, A.A. Shahidani, S.H. Sadeghi. 2017. Effect of Treflan injection on root characteristics of Festuca and Bermuda grass to prevent emitters clogging by roots in subsurface drip irrigation. ASABE, Annual International Meeting, Spokane, WA., July 16–19, 2017.
6. **Molaei, B.**, M. Gheysari, B. Mostafazadeh-Fard, S.H. Sadeghi, M.M. Majidi, K. Molaei. 2016. Effect of cattle manure and Organi Humme catalyzer on potato production in an arid region. ASABE, Annual International Meeting, Orlando, FL., July 17–20, 2016. 162460219, doi:10.13031/aim.20162460219.
7. **Molaei, B.**, M. Gheysari, B. Mostafazadeh-Fard, S.H. Sadeghi, S. Landi, K. Molaei. 2016. Tuber yield, irrigation water uses efficiency and starch content of two potato varieties as affected by drip-tape and solid set irrigation systems. ASABE, Annual International Meeting, Orlando, FL., July 17–20, 2016. 162460172, doi:10.13031/aim.20162460172.0

CONTRIBUTION IN FUNDED GRANTS

1. Walsh, D., R.T. Peters, **B. Molaei**, and R. Baker. 2022. Nitrogen and Water Management on Spearmint. \$48,178
2. Peters, R.T., and **B. Molaei**. 2019. Large Scale Evaluation of a LEPA/LESA system compared to MESA on Spearmint and Peppermint. Idaho Industry Research Council. \$5,000

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3. Peters, R.T., and **B. Molaei**. 2019. Large Scale Evaluation of a LEPA/LESA system compared to MESA on Spearmint and Peppermint. Oregon Industry Research Council. \$5,000
 4. Peters, R.T., and **B. Molaei**. 2019. Large Scale Evaluation of a LEPA/LESA system compared to MESA on Spearmint and Peppermint. Mint Industry Research Council. \$5,165
 5. Peters, R.T., and **B. Molaei**. 2019. Large Scale Evaluation of a LEPA/LESA system compared to MESA on Spearmint and Peppermint. Washington Mint Commission. \$14,202
 6. Peters, R.T., **B. Molaei**, and L. Lommers. 2019. Mars Wrigley's Confectionery Sustainable Agricultural Funding for North America Mint Farmers. Mars-Wrigley's Confectionary. \$25,000
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TECHNICAL REPORTS FOR FUNDED PROJECTS

1. **Molaei, B.**, Walsh, D.B., R.T. Peters, R. Baker, R. Qin. 2022. Nitrogen and Water Management on Spearmint. Report to Washington Mint Commission and MIRC. November 2022
 2. Walsh, D.B., R.T. Peters, R. Baker, **B. Molaei**, R. Qin. 2021. Nitrogen and Water Management on Spearmint. Report to Washington Mint Commission and MIRC. November 2021.
 3. Walsh, D.B., R.T. Peters, R. Baker, **B. Molaei**, R. Qin. 2020. Nitrogen and Water Management on Spearmint. Report to Washington Mint Commission and MIRC. November 2020.
 4. **Molaei, B.** and R.T. Peters. 2019. Mobile Drip Irrigation: A review. Bonneville Power Administration. Washington. August 2019. Research Report submitted to Bonneville Power Administration.
 5. **Molaei, B.** and R.T. Peters. 2019. Variable Rate Irrigation Systems: A review. Bonneville Power Administration. Washington. August 2019. Research Report submitted to Bonneville Power Administration.
 6. Peters, R.T., and **B. Molaei**. 2019. Large-Scale Evaluation of a LEPA/LESA system compared to MESA on Spearmint and Peppermint. Research Report submitted to Oregon Mint Commission, Washington Mint Commission, and MIRC. November. 2019.
 7. Peters, R.T., and **B. Molaei**. 2018. Large-Scale Evaluation of a LEPA/LESA system compared to MESA on Spearmint and Peppermint. Research Report submitted to Oregon Mint Commission, Washington Mint Commission, and MIRC. Sept. 2018.
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