

Suzanne TOUZEAU

Born 20th December 1970

French

ISA – M2P2

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INRAE researcher in mathematical epidemiology

Nov. 2012– **M2P2** team, Institut Sophia Agrobiotech (**MathNum** division)
& **MACBES** team, Centre Inria d'Université Côte d'Azur

2000–2012 Applied Mathematics and Informatics research unit, INRA, Jouy-en-Josas

Education

1997 **PhD in Engineering Sciences**, Université Nice Sophia Antipolis, France: *Control models in fisheries*.

1993 **Master in Industrial Control**, ECL, INSA-Lyon, Universités Lyon 1 & Savoie, France.

1993 **Graduate degree in General Engineering**, École Centrale de Lyon (ECL), France.

Post-doctoral research experience

May–Nov. 2000 University of Edinburgh, Veterinary Epidemiology Group, Scotland.

March 1998 – Dec. 1999 CSIC, Institut de Ciències del Mar, Barcelona, Spain (EU Marie Skłodowska-Curie grant).

Sep. 1997 – Jan. 1998 Helsinki University of Technology, Systems Analysis Laboratory, Espoo, Finland.

April–July 1997 IFREMER, Laboratoire MAERHA, Nantes, France.

Research interests

- Development and analysis of mathematical models in **population dynamics**.
 - Mathematical analysis: model reduction, stability, control.
 - Numerical exploration: parameter identification, sensitivity analysis, simulation.
- Main applications in **crop protection**: plant pest and disease epidemiology; management of crop resistance; design, assessment and optimisation of sustainable control measures.
- Past applications in farm animal epidemiology and immunology, and in fishery management.

Main ongoing research projects

BEEP Behavioural Epidemiology and Evolution of Plant Pathogens, ANR [French National Research Agency], 2024–2028.

ENDURANCE ENhanced DURability AgaiNst Crop Enemies, ANR, 2024–2027.

PAPEETE Promoting agroecology through the integrative prediction of health risks using participatory epidemiological surveillance data at territorial scale, Écophyto [French plan to reduce and improve the use of plant protection products], 2024–2027.

AID DS Cerise For and integrated and sustainable approach to the management of *Drosophila suzukii* in the cherry sector, Écophyto, 2024–2026.

MISTIC Computational models of crop plant microbial biodiversity, PEPR [French Research Priority Equipments and Programs] Agroecology and ICT, 2023–2028.

NEM-EMERGE An integrated set of novel approaches to counter the emergence and proliferation of invasive and virulent soil-borne nematodes, Horizon Europe, Farm2fork, 2023–2027.

SuzuKIISS:ME Managing *Drosophila SuzuKII* thanks to SuperSterile Insects: Maturation and Efficiency, ANR / Écophyto, 2022–2025.

EPITAG EPIdemiological modelling and control for Tropical AGriculture, Inria Associate team with Cameroon universities, 2017–2024; INRAE, TSARA programme, 2022–2024 – principal investigator.

Postdoc & student supervision

Postdocs

- Natacha Go, *Immuno-epidemiological modelling*, 2015–2017.
- Jordi FERRER SAVALL, *Modelling Salmonella spread along the pork supply chain*, 2014–2015.
- Sébastien GAUCEL, *Modelling and simulation in veterinary epidemiology*, 2006–2007.

PhD

- Frank KEMAYOU, *Mathematical modelling and analysis of *Radopholus similis* impact on plantain production*, University of Douala, Cameroon, 2022– (EPITAG support).

- Joseph PENLAP TAMAGOUA, *Ecophysiological modeling of plant-nematode interactions. Understanding the origins and consequences of differential plant susceptibility*, Université Côte d'Azur, ED STIC, 2022–2025 (Inria–INRAE funding).
- Marine COURTOIS, *Modeling the sterile insect technique in an agricultural context: how to integrate biological and technical realities to optimize its deployment?*, Université Côte d'Azur, ED SVS, 2022–2025 (INRAE funding)
- Aurelien KAMBEU YOUNBI, *Development and analysis of a self-financing model for cabbage crop including pest control*, University of Dschang, Cameroon, 2020– (EPITAG support),.
- Clotilde DJUIKEM, *Modelling and control of perennial plant phytopathogens*, Université Côte d'Azur, ED STIC, 2019–2023 (Inria funding, EPITAG support), HAL: [tel-04026720](#).
- Yves FOTSO FOTSO, *Modelling, analysis and control of coffee berry borer*, University of Dschang, Cameroon, 2016–2022 (EPITAG support), HAL: [tel-03608463](#).
- Israël TANKAM CHEDJOU, *Modelling, analysis and control of plantain plant-parasitic nematodes*, University of Yaoundé I, Cameroon, 2015–2021 (EPITAG support), HAL: [tel-03217816](#).
- Samuel NILUSMAS, *Sustainable management of root-knot nematodes in horticultural crops: modelling and optimisation of resistance deployment and agricultural practices*, Université Côte d'Azur, ED STIC, 2016–2020 (INRA & PACA region funding), HAL: [tel-03185191](#).
- Natacha GO, *Modelling the immune response to the Porcine Respiratory and Reproductive Syndrome virus*, AgroParis-Tech, ED ABIES, 2011–2014 (ED funding), HAL: [tel-01100983](#).
- Antoine PERASSO, *Parameter identifiability for systems described by partial differential equations: application to population dynamics*, Université Paris-Sud 11, ED MathSTIC, 2006–2009 (ED funding), HAL: [tel-00464272](#).
- Najat ZIYADI, *Studying mathematical and individual-based models in epidemiology: application to scrapie transmission dynamics in a sheep flock*, Cadi Ayyad University, Marrakech, Morocco, 2004–2008 (IRD grant), HAL: [tel-02823529](#).
- Amandine LURETTE, *Modelling to assess control measures for Salmonella carriage in slaughter pigs*, Université Rennes 1, ED VAS, 2004–2007 (INRA ASC funding), HAL: [tel-02823809](#).

Internships 18 Master and 4 Bachelor interns, 2004–2023.

Teaching experience

Graduate courses

- *Data analysis*, Polytech Nice Sophia, 4th Engineering year, 2014–2019 (25–35 hours/year).
- *Epidemiological modelling*, AgroParisTech, Paris, 2002–2011 (3–9 hours/year).

Research schools

- CIMPA Mathematical and statistical modeling of complex systems, N'Djamena, Chad, Jan. 2023 – lecturer.
- CIMPA Vert Numérique: biologie mathématique et écologie théorique, Tunisia, Sep. 2022 – co-organiser and lecturer.
- Data and Models in Ecology and Evolution, Institut Pascal, France, July 2019 – lecturer.
- CIMPA-CETIC Mathematical and Computer Models in Epidemiology, Ecology and Agronomy, Yaoundé, Cameroon, Sep. 2016 – scientific committee member and lecturer.
- **EpiCasa** Introduction to epidemiology: mathematical and statistical models and methods, Casablanca, Morocco, Nov. 2007, April 2010 & April 2012 (CIMPA school) – organiser and lecturer.
- UNESCO Chair in Mathematics and Development, 5th Semester Mathematics for life sciences, Tunis, Tunisia, Feb. 2007 – lecturer.
- CIMPA-UNESCO Mathematical tools and methods for the analysis and the regulation of fisheries, Nouadhibou, Mauritania, July 2005 – lecturer.

Scientific expertise

PhD examination committees

- Andrea RADICI, Avignon Université, 2023.
- Stefano CASAGRANDA, Université Nice Sophia Antipolis, 2017, HAL: [tel-02169197](#).
- David DEMORY, Université Pierre et Marie Curie, 2017, HAL: [tel-01653093](#).
- Aurélie COURCOUL, Université Rennes 1, 2010, HAL: [tel-00591053](#).
- Sapna NUNDLOLL, Université Nice Sophia Antipolis, 2009, HAL: [tel-00850358](#).

Selection boards

- INRA/INRAE junior research scientists (various research profiles), 2008–2024.
- University of Bordeaux lecturer (applied mathematics), 2018.
- AgroParisTech lecturer (applied mathematics), 2015.
- INRA engineers (scientific computing), 2002 & 2006.
- INRA “ASC” [6-year doctoral + postdoctoral grants], 2004 & 2010.

Other committees

- **Ovide Arino Outreach Award** committee, ESMTB & SFBT, since 2019.
- Ibni Prize awarding committee, 2022.
- Inria national commission for secondment of researchers, 2021.
- INRAE, Sustainable Management of Crop Health (SuMCrop) metaprogramme steering committee, since 2016.
- INRAE, Institut Sophia Agrobiotech council, since 2016 – elected member.
- Inria, International Laboratory for Computer Sciences and Applied Mathematics (LIRIMA) evaluation panel, 2014.
- INRA, CSS [researcher evaluation] in Mathematics, Bioinformatics and Artificial Intelligence, 2007–2015 – appointed & board member.
- INRA, Applied Mathematics and Informatics division, scientific committee, 2006–2016 – elected member.
- Ministry of Agriculture, CNECA [lecturer evaluation], section 3, 2006–2013 – alternate appointed member.

Academic editor for *PLOS ONE*, since 2018.

Recent publications

- [1] DJUIKEM, C., GROGNARD, F., and TOUZEAU, S., 2023. Impulsive modelling of rust dynamics and predator releases for biocontrol. *Mathematical Biosciences*, 356: 108968. DOI: [10.1016/j.mbs.2023.108968](https://doi.org/10.1016/j.mbs.2023.108968) – HAL: [hal-03952381](https://hal.archives-ouvertes.fr/hal-03952381)
- [2] FOTSO FOTSO, Y., TOUZEAU, S., GROGNARD, F., TSANOU, B., and BOWONG, S., 2023. Optimal control of coffee berry borers: synergy between bio-insecticide and traps. *Journal of Optimization Theory and Applications*, 196(3): 882–899. DOI: [10.1007/s10957-022-02151-7](https://doi.org/10.1007/s10957-022-02151-7) – HAL: [hal-03954863](https://hal.archives-ouvertes.fr/hal-03954863)
- [3] SAUBIN, M., LOUET, C., BOUSSET, L., FABRE, F., FUDAL, I., GROGNARD, F., HAMELIN, F. M., MAILLERET, L., STOECKEL, S., TOUZEAU, S., PETRE, B., and HALKETT, F., 2023. Improving sustainable crop protection using population genetics concepts. *Molecular Ecology*, 32(10): 2461–2471. DOI: [10.1111/mec.16634](https://doi.org/10.1111/mec.16634) – HAL: [hal-03394837](https://hal.archives-ouvertes.fr/hal-03394837)
- [4] FOTSO, Y. F., TOUZEAU, S., TSANOU, B., GROGNARD, F., and BOWONG, S., 2022. Mathematical modelling of a pest in an age-structured crop model: The coffee berry borer case. *Applied Mathematical Modelling*, 110: 193–206. DOI: [10.1016/j.apm.2022.05.042](https://doi.org/10.1016/j.apm.2022.05.042) – HAL: [hal-03699541](https://hal.archives-ouvertes.fr/hal-03699541)
- [5] DEMORY, D., WEITZ, J., BAUDOUX, A.-C., TOUZEAU, S., SIMON, N., RABOUILLE, S., SCIANDRA, A., and BERNARD, O., 2021. A thermal trade-off between viral production and degradation drives phytoplankton-virus population dynamics. *Ecology Letters*, 24(6): 1133–1144. DOI: [10.1111/ele.13722](https://doi.org/10.1111/ele.13722) – HAL: [hal-03066279](https://hal.archives-ouvertes.fr/hal-03066279)
- [6] DJUIKEM, C., GROGNARD, F., TAGNE WAFO, R., TOUZEAU, S., and BOWONG, S., 2021. Modelling coffee leaf rust dynamics to control its spread. *Mathematical Modelling of Natural Phenomena*, 16: 26. DOI: [10.1051/mmnp/2021018](https://doi.org/10.1051/mmnp/2021018) – HAL: [hal-03188365](https://hal.archives-ouvertes.fr/hal-03188365)
- [7] FOTSO FOTSO, Y., TOUZEAU, S., TSANOU, B., BOWONG, S., and GROGNARD, F., 2021. Modelling and optimal strategy to control coffee berry borer. *Mathematical Methods in the Applied Sciences*, 44(18): 14569–14592. DOI: [10.1002/mma.7726](https://doi.org/10.1002/mma.7726) – HAL: [hal-03334090](https://hal.archives-ouvertes.fr/hal-03334090)
- [8] TANKAM CHEDJOU, I., GROGNARD, F., TEWA, J.-J., and TOUZEAU, S., 2021. When and how to fallow: first steps towards banana crop yield improvement through optimal and sustainable control of a soilborne pest. *Journal of Interdisciplinary Methodologies and Issues in Science*, 8 – Digital Agriculture in Africa. DOI: [10.18713/JIMIS-120221-8-4](https://doi.org/10.18713/JIMIS-120221-8-4) – HAL: [hal-03103785](https://hal.archives-ouvertes.fr/hal-03103785)
- [9] TANKAM CHEDJOU, I., GROGNARD, F., TEWA, J. J., and TOUZEAU, S., 2021. Optimal and sustainable management of a soilborne banana pest. *Applied Mathematics and Computation*, 397: 125883. DOI: [10.1016/j.amc.2020.125883](https://doi.org/10.1016/j.amc.2020.125883) – HAL: [hal-03111065](https://hal.archives-ouvertes.fr/hal-03111065)
- [10] EZANNO, P., ANDRAUD, M., BEAUNÉE, G., HOCH, T., KREBS, S., RAULT, A., TOUZEAU, S., VERGU, E., and WIDGREN, S., 2020. How mechanistic modelling supports decision making for the control of enzootic infectious diseases. *Epidemics*, 32: 100398. DOI: [10.1016/j.epidem.2020.100398](https://doi.org/10.1016/j.epidem.2020.100398) – HAL: [hal-02895529](https://hal.archives-ouvertes.fr/hal-02895529)
- [11] NILUSMAS, S., MERCAT, M., PERROT, T., DJIAN-CAPORALINO, C., CASTAGNONE-SERENO, P., TOUZEAU, S., CALCAGNO, V., and MAILLERET, L., 2020. Multi-seasonal modelling of plant-nematode interactions reveals efficient plant resistance deployment strategies. *Evolutionary Applications*, 13(9): 2206–2221. DOI: [10.1111/eva.12989](https://doi.org/10.1111/eva.12989) – HAL: [02775269](https://hal.archives-ouvertes.fr/02775269)
- [12] TANKAM CHEDJOU, I., TOUZEAU, S., MAILLERET, L., TEWA, J.-J., and GROGNARD, F., 2020. Modelling and control of a banana soilborne pest in a multi-seasonal framework. *Mathematical Biosciences*, 322: 108324. DOI: [10.1016/j.mbs.2020.108324](https://doi.org/10.1016/j.mbs.2020.108324) – HAL: [hal-02775460](https://hal.archives-ouvertes.fr/hal-02775460)

Misc

- Member of scientific societies:
 - African Society in Digital Science (ASDS), since 2024;
 - Centre International de Mathématiques Pures et Appliquées (CIMPA), since 2023;
 - Société Francophone de Biologie Théorique (SFBT), since 2022;
 - Society for Mathematical Biology (SMB), since 2020;
 - European Society for Mathematical and Theoretical Biology (ESMTB), since 2004.
- Elected board member of ADAS [works council for social activities], INRA Jouy-en-Josas, 2002–2010.