

UNIVERSIDAD DE LA FRONTERA

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales



**EFFECT OF DRYING AND REWETTING AND FREEZING
AND THAWING CYCLES ON SOIL CARBON
SEQUESTRATION IN A HUMID TEMPERATE FOREST SOIL:
UNDERLYING MECHANISMS**

**DOCTORAL THESIS IN FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE
DOCTOR OF SCIENCES IN NATURAL
RESOURCES**

FRANCISCO JOSÉ NÁJERA DE FERRARI

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“Effect Of Drying and Rewetting and Freezing And Thawing Cycles On Soil Carbon Sequestration In A Humid Temperate Forest Soil: Underlying Mechanisms”

Esta tesis fue realizada bajo la supervisión del director de tesis, Dr. Francisco Matus del departamento de Ciencias Químicas y Recursos Naturales de la Universidad de la Frontera y ha sido aprobada por los miembros de la comisión examinadora.

.....
Dr. Francisco Matus Baeza
DIRECTOR DEL PROGRAMA DE
DOCTORADO EN CIENCIAS DE
RECURSOS NATURALES

.....
Dr. Francisco Matus

.....
Dr. Víctor Beltrán Varas
DIRECTOR ACADEMICO DE
POSTGRADO
UNIVERSIDAD DE LA FRONTERA

.....
Dra. Michaela
Dippold

.....
Dr. Jens Boy

.....
Dr. Yakov Kuzyakov

.....
Dr. Oscar Seguel

.....
Dra. María Cristina Diez

.....
Dr. Fernando Borie

Thesis summary

Soil microbial respiration plays a significant role in ecosystem functions, influenced by freezing and thawing (F/T) and drying and wetting (D/W) cycles. We investigated their impact on soil aggregates and particulate organic matter (POM) dynamics in Nahuelbuta National Park. Three experiments were conducted: one and four D/W cycles with ^{13}C -lignocellulose on undisturbed soil samples at 5°C and 25°C ; F/T and D/W cycles with ^{14}C glucose and ^{13}C -lignocellulose; and a third incubation assessing microbial exoenzyme activity, soil organic matter (SOM) decomposition, and SOM quality through various analyses. CO_2 efflux increased threefold at 25°C compared to 5°C , decreasing with D/W cycles. The priming effect (PE) was negative in both experiments. CO_2 originated mainly from fPOM in disrupted macroaggregates. Glucose was found in silt+clay, while lignocellulose was present in macro and microaggregates. F/T and D/W cycles exhibited non-equivalent effects, both triggering a negative PE, and the microbial community increased exoenzyme activity to decompose fPOM.